

FRACTURES
OF THE
EXTREMITIES.

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Plate 20.

Fig. 2

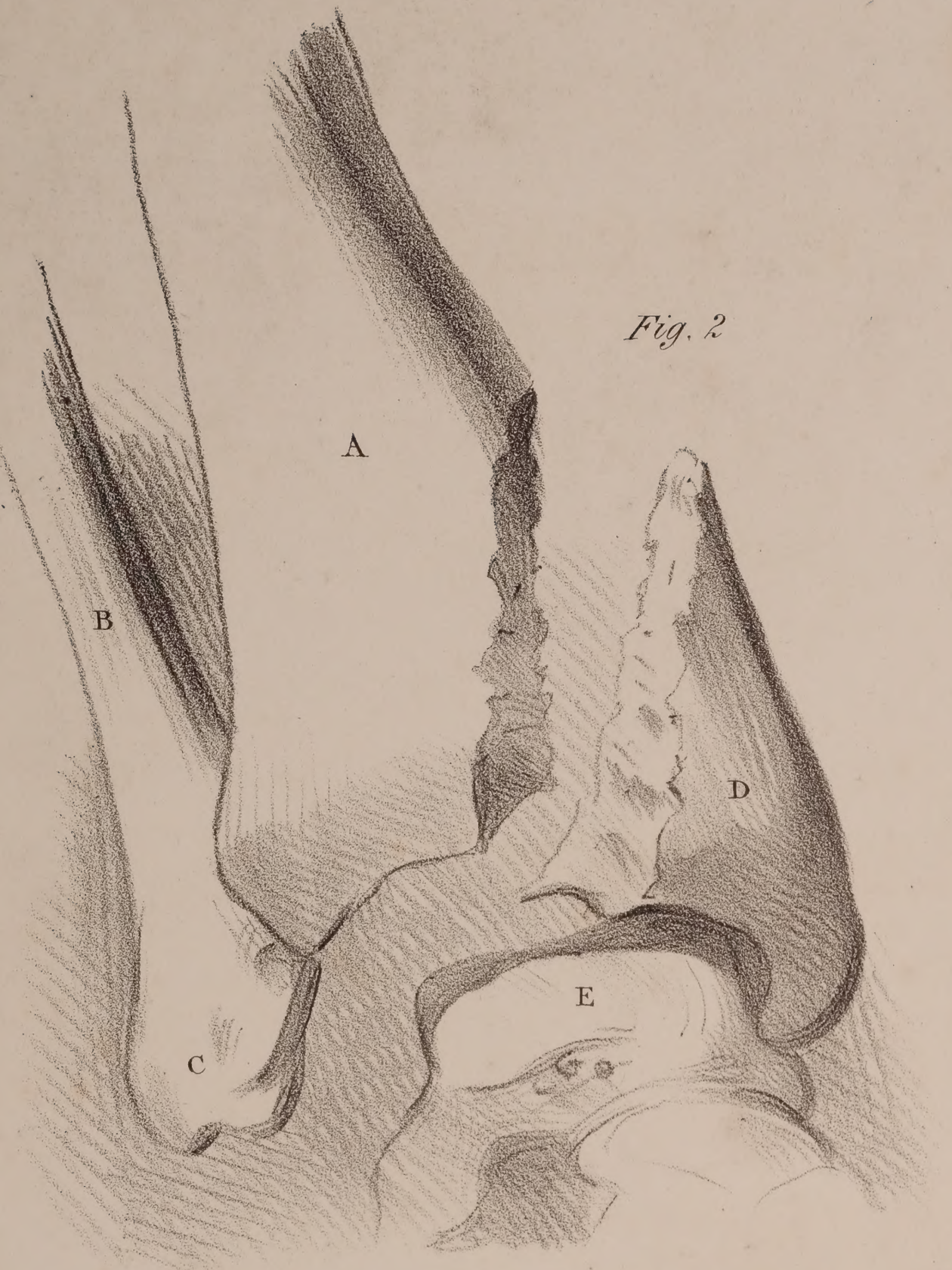


Fig. 1.



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A

SERIES OF TWENTY PLATES

ILLUSTRATING THE

CAUSES OF DISPLACEMENT

IN THE VARIOUS FRACTURES OF THE

BONES OF THE EXTREMITIES.

BY G. W. HIND,

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1835.

TABLE OF THE FIRST PLATE

CASES OF DISPLACEMENT

BOXES OF THE EXTREMITY

THE END

TO
SIR CHARLES BELL, K.G.H.

F.R.S. L. & E. &c. &c. &c.

DEAR SIR,

In presenting to public notice the following pages, it will not excite surprise, that I should be anxious to obtain the sanction and patronage of a high medical name;—a name which attaches to a gentleman in whom are united all the great and distinguishing qualities which add dignity to the profession of which I am proud to be a member, though treading on the path of medical and anatomical fame at a humble distance, and under great self humility.

From you, Sir, it was my privilege to derive the elementary principles of our enlightened science; under you to advance in riper acquaintance with their combinations and influence; and even now, in cases of doubt and complexity, it is not the less so to enjoy the benefit of your matured opinion and advice. If in the work which I now with diffidence commit to public ordeal any merit shall be perceived, or if from it any benefit shall be derived, it will not only be an act of justice to you, Sir, but of pleasure to myself, to recognize as the cause, those rare advantages which, under your tuition, were so long enjoyed by,

Dear Sir,

Yours, with every sentiment of respect and regard,

G. W. HIND.

66, Gower-street, Bedford-square,

April 1835.

PREFACE.

IN offering this treatise to the reader, it is hoped that it may not be considered an unnecessary addition to those highly valuable works upon the same subject which have been already submitted to the public.

The object of these pages is not an attempt to point out deficiencies in other authors, or to adopt any new mode of treatment, but solely to introduce to the view of the student such plans of the different fractures of the bones of the extremities, as may enable him at once to effect the reductions necessary, and suggest to him the principle upon which they should be treated.

The chief object has been to examine accurately the various *causes of displacement* that are to be found in the different situations where fracture may have taken place; also to investigate the mechanical injury dependent on the manner in which the force or weight may have been applied, and then, from the result of these inquiries, the student will be able to deduce the principles upon which to regulate the treatment.

In order to render the description of each plate as concise as possible, all reference to preliminary treatment has been purposely avoided, and the *causes of displacement*, together with the subsequent treatment, expressly made the principal object.

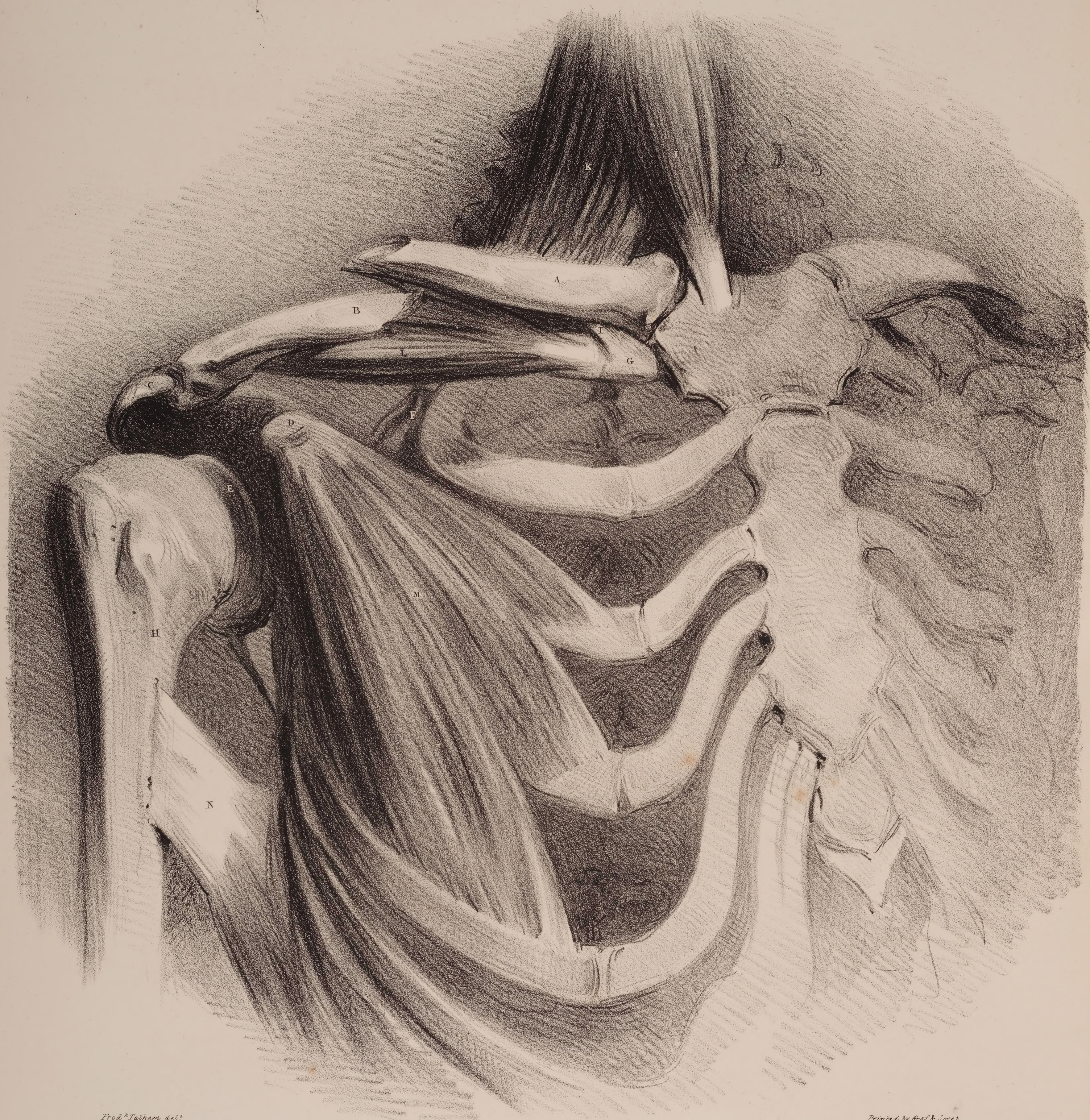
It may be necessary here to state, that the plans were originally drawn by the author, and completed from the recent subject by the artist, Mr. F. Tatham; the style differs much from that usually adopted, and is, perhaps, more consistent with the character of bone and muscle than that which is generally in use.

As the work is purely demonstrative of causes and effects, it merely admits of plain narrative, alike free from verbal embellishment and figurative illustration, which, indeed, would rather disguise its simplicity; consequently, the writer has felt it unnecessary to apologise for any deficiency of style which may be observed. Should the accompanying pages merit approbation, it is his intention to submit to the public a series of plates, upon the same plan, showing the causes of displacement and retention in the various dislocations.

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Plate 1.



Fred. Tatham del.

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FRACTURES OF THE EXTREMITIES.

PLATE I.

FRACTURE OF THE CLAVICLE.

- | | |
|--------------------------------------|--|
| A. Sternal portion of the Clavicle. | H. Os humeri. |
| B. Acromial portion of the Clavicle. | I. Rhomboid, or Costo-clavicular ligament. |
| C. Acromion process of the Scapula. | J. Sternal portion of the Sterno-cleido-mastoideus. |
| D. Coracoid process of the Scapula. | K. Clavicular portion of the Sterno-cleido-mastoideus. |
| E. Glenoid cavity of the Scapula. | L. Subclavius muscle. |
| F. Superior angle of the Scapula. | M. Pectoralis minor. |
| G. Cartilage of the First Rib. | N. Latissimus dorsi. |

CAUSES OF FRACTURE.

THE clavicle is peculiarly liable to fracture, from its exposed situation. It forms the fulcrum upon which the upper extremity is moved; consequently, in every change of position of the scapula, it is the centre of motion, and must necessarily suffer, in common with the bones of the upper extremity, the force transmitted through more or less of their extent. It will be remembered that the clavicle is of an arched form, the convexity looking forwards; it is also hollowed out on the lower surface, in order to prevent the vessels and nerves passing to and from the axilla suffering from pressure. Fracture of this bone usually occurs from a blow or fall on the outer part of the shoulder, which forces the scapula violently inwards towards the chest. The strong and moveable attachments of the two ends of the clavicle, the inner to the sternum, the outer to the acromion process of the scapula, are partly the means of protecting it from fracture; for it yields in some measure to force applied in either of these directions. The arched form of the bone is likewise a means of protection against fracture, when the injury is directed from above or before: but even under these circumstances it occasionally gives way, though rarely.

When the force is applied to the outer extremity of the bone, the arched form affords no protection against fracture, but is, on the contrary, the means of diminishing its strength; for now the two extremities are forced towards each other, and fracture takes place in the centre of the arch, which is in this direction its weakest point.

APPEARANCES.

When the clavicle is thus fractured, the appearances presented cannot be mistaken. The broken ends are seen projecting, the sternal portion being the more prominent, and the integument drawn tightly over it; while the extremity of the acromial portion is seen projecting, but only in a very slight degree, and on a lower level. It can likewise be observed that the inner portion rides over the outer; the length of the clavicle is diminished, and the shoulder consequently brought nearer to the chest; the arm hangs useless by the side, and in close relation with it. The general squareness of the shoulder is no longer observable, and the patient is incapable of raising the hand to the head; the fulcrum, by the attachment of which the scapula is held up in its natural situation, and upon which it moves, being lost. Such, then, are the characters. Little manual examination is here necessary: by passing the fingers along the upper edge of the clavicle, the exact situation of the fracture is immediately discovered; at the same time, by grasping the shoulder with the other hand and drawing it outwards, as well as raising the scapula, the two ends of the fractured portions are brought into contact, and the crepitus can be distinctly perceived.

CAUSES OF DISPLACEMENT.

The two portions of the bone will be found to be acted upon, by the muscles that are attached to them, each in a different manner, which will account for the displacement. The inner portion, or sternal extremity, will retain nearly its natural position; but it will incline slightly forwards. It may be said, why does not the sterno-cleido-mastoideus draw it upwards?—so it does: but yet it is only to the extent of supporting it in its natural situation; not beyond this. There is a strong ligament (the costo-clavicular) which runs from the cartilage of the first rib to the lower surface of the neck of the clavicle, and it is this which controls the elevation of the inner fractured portion. Independently of this, the attachment of the clavicular portion of the pectoralis major counteracts the muscle attached above (the sterno-cleido-mastoideus), and gives the broken end an oblique direction forwards.

The outer or acromial portion is displaced as seen in the plate. This portion of the bone falls from its natural level, and is drawn at the same time inwards towards the sternum, passing to a certain degree below the broken extremity of the sternal portion of the clavicle. The causes of the displacement will be found principally to depend upon the weight of the arm drawing down the scapula; and with it, necessarily, the outer portion of the clavicle to which it is attached, where it is held by the pectoralis minor and latissimus dorsi. Independently of the depression of this portion of the bone, it has to be explained why it is drawn forwards and inwards: this arises from the action of the subclavius muscle, whose attachment to the cartilage of the first rib, as its fixed point, gives the broken bone that direction; it is held firmly by the muscle in this situation, and it is this circumstance which causes the chief difficulty in the treatment of the fracture of the clavicle. Were it not for the weight of the extremity, very little displacement would occur further than the drawing in of the outer portion by the subclavius, for the outer portion of the clavicle would then be held in its natural position by the trapezius. The scapula itself is turned upon its axis, the glenoid cavity being depressed from the causes enumerated above; so that the base, instead of being nearly parallel with the spine, now takes a new direction, viz. the inferior angle is approximated to the spine, and is there held by the rhomboideus major, while the superior angle is pulled from the spine by the weight of the arm, and raised by the trapezius, levator scapulæ, and rhomboidei muscles.

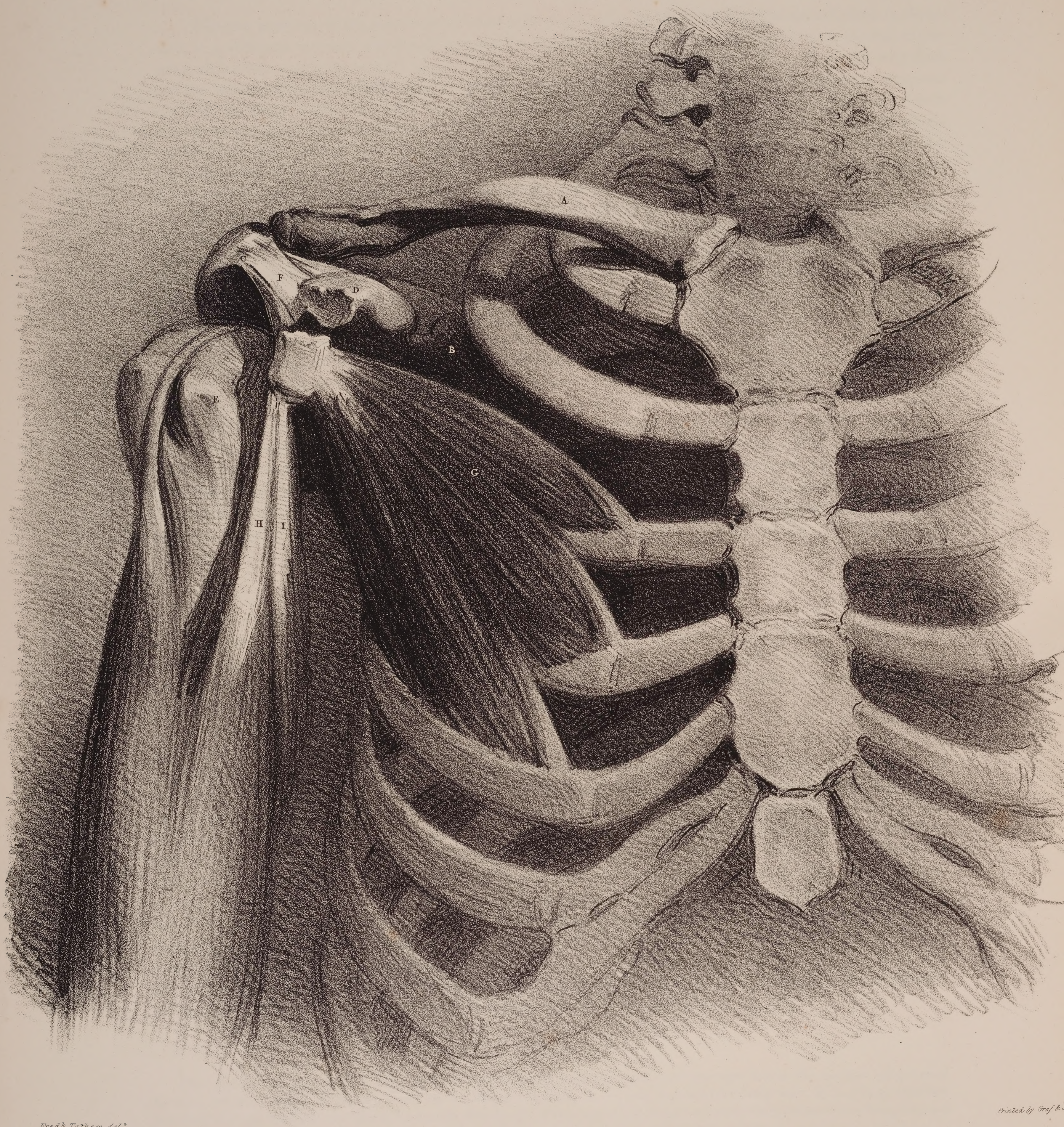
TREATMENT.

Upon the basis of the foregoing facts, the plan of treatment becomes at once evident. It consists, in the first place, in bringing the acromial extremity outwards, and on the same line with the fractured extremity of the inner portion; and, in the second place, in raising the scapula and outer portion of the clavicle to its original level with the sternal or fixed portion.

To accomplish the first object, a firm pad should be adapted to the axilla; this will have the effect of pressing out the head of the humerus and scapula, by which means the action of the subclavius will be in a great measure overcome, and, consequently, the acromial portion of the clavicle drawn outwards, though not to its full extent; a broad flannel bandage is now to be passed over the shoulders of both sides, in the form of a figure of ∞ , so as to fix the compress, and to cross at the upper part of the back. This will have the effect of drawing backwards and fixing the shoulders, while it will assist in pulling the acromial portion still more outwards. This being done, the most important part remains; the pad in the axilla is now to be made a fulcrum upon which the humerus at its neck may act as a lever: in order to accomplish this, the elbow is to be bound firmly to the side of the chest, by which means the head of the bone will be thrown outwards, drawing with it the scapula and outer portion of the clavicle; and thus another method is afforded of counteracting the effect of the subclavius muscle. The arm is next to be raised by bringing a bandage over the shoulder of the uninjured side, across the chest, to the elbow and fore-arm of the opposite side. By this means the scapula, and with it the broken portion of the clavicle, will be elevated, and the whole parts will be adjusted in their natural situations.

NOTE.

This drawing was made from a female subject, and shows the deformity consequent upon tight lacing; the sternum being pushed forwards, and the cartilages of the second and all the inferior ribs forced downwards, the interval between each rib is thus considerably increased, and the cavity of the thorax necessarily diminished. The action of the diaphragm under these circumstances being impeded by the diminution of the arc to which it is attached, the respiration must have suffered to a certain degree.



Fred^d Tatham del^o

Engraved by Gray & Co.

PLATE II.

FRACTURE OF THE CORACOID PROCESS OF THE SCAPULA.

- | | |
|---|--|
| A. The Clavicle. | F. The Coraco-acromial or Deltoid ligament. |
| B. The Scapula. | G. The Pectoralis minor. |
| C. The Acromion process of the Scapula. | H. The short head of the Biceps Flexor Cubiti. |
| D. The Coracoid process of the Scapula fractured. | I. The Coraco-brachialis. |
| E. The Humerus. | |

CAUSES OF FRACTURE.

This fracture is of rare occurrence, and is occasioned by a blow immediately upon the point of the coracoid process, when it gives way usually about midway between its root and its extremity. The rare occurrence of fracture of this portion of the scapula is accounted for by its protected situation ; being, as it were, guarded behind and above by the clavicle and acromion process of the scapula, and on the outside by the head of the humerus ; it is exposed only on the anterior part, and even here is protected by the projections of the shoulder and thorax, so that the force must be applied in the concavity between the head of the humerus and upper part of the thorax.

APPEARANCES.

The appearances, when this accident has occurred, present no deviation from the natural condition of the parts, with the exception of the consequent tumefaction, no external deformity taking place ; and it is only by the patients referring you to the seat of pain, and their partial loss of control over the motions of the upper extremity, that you are directed to the seat of the injury.

Upon examination, the detached portion of the coracoid process is found drawn downwards beyond its usual level, and the finger may be inserted in the space existing between the two portions, when the broken surfaces of either can be readily distinguished. No crepitus is felt until the humerus is raised and thrown forwards across the thorax, the fore-arm at the same time being flexed, in which position those muscles which have displaced the loose portion are partly relaxed : the thumb being now placed in the axilla, and the fingers grasping the broken portion on the anterior part, it is brought upwards to its natural situation, when the crepitation is at once distinguished.

CAUSES OF DISPLACEMENT.

The causes of the displacement will be at once evident by reference to the plate. The muscles displacing the loose portion of the bone are, the pectoralis minor, whose action draws it slightly inwards towards the thorax, while the conjoined tendons of the coraco-brachialis and short head of the biceps, which are attached to the tip, draw it directly downwards ; but the limit of its descent is controlled by the attachment of a strong ligament running from the tip of the acromion to the whole extent of the coracoid process,—the coraco-acromial or deltoid ligament.

TREATMENT.

The treatment in this case is at once simple and easy of application ; and consists, first, in flexing the fore-arm and bringing the arm over the chest, so that the hand of the injured side grasps the opposite shoulder ; by these means the biceps and coraco-brachialis are considerably relaxed : the only remaining cause of displacement is the pectoralis minor, whose action may be counteracted by placing a soft pad in

the axilla behind the tendon of the pectoralis major, which should be supported by another bandage firmly applied over the shoulder. The humerus should then be pushed upwards, so that the head of the bone pressing up the coraco-acromial ligament raises with it the displaced portion of the bone; a firm bandage being now passed over the upper part of the shoulder, crossing the spine of the scapula and the clavicle, is to be carried down over the anterior part of the shoulder between the arm and the chest to the inner part of the fore-arm near the elbow, which should be made to cross exactly in the opposite direction, thus forming a figure of ∞ from the shoulder to the fore-arm: in this way the humerus is fixed, and the loose portion of the coracoid process raised to its natural situation, by means of the triangular ligament. This bandage has likewise the effect of drawing the scapula forwards and downwards; so that the broken surface of the fixed portion of the coracoid process is depressed, and comes more readily in contact with the loose portion. In this situation the arm should be firmly fixed by a broad flannel roller enveloping the whole of the extremity, and crossing above the shoulder of the opposite side.



Fred. Tatham del.

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PLATE III.

FRACTURE OF THE ACROMION PROCESS OF THE SCAPULA.

- | | |
|---|---|
| A. The Clavicle. | G. The shaft of the Humerus. |
| B. The Coracoid process of the Scapula. | H. The Levator Scapulæ muscle. |
| C. The detached portion of the Acromion process of the Scapula. | I. The Trapezius muscle ; the Clavicular portion of which is removed. |
| D. The broken surface of the spine of the Scapula. | J. The Deltoid muscle. |
| E. The head of the Humerus. | K. The Subclavius muscle. |
| F. The inferior costa of the Scapula. | L. The Pectoralis minor. |
| | M. The tendon of the Latissimus dorsi. |

CAUSES OF FRACTURE.

The fracture of the acromion process of the scapula is much more frequent in its occurrence than the preceding, from its being more exposed to injury. It arises from direct violence applied to the upper and outer part of the shoulder.

APPEARANCES.

The accident is characterised by the following appearances. The shoulder loses its rotundity ; a slight prominence is seen on the anterior part, while the posterior and upper part presents an irregularity, from the fixed surface of the broken spine of the scapula being slightly elevated. The scapula is drawn upwards and backwards, and the shoulder brought nearer the thorax. The clavicle, likewise, will be found to have suffered some change in its position, the acromial extremity being somewhat depressed ; while the sternal extremity, at the upper part, becomes more prominent than on the opposite side. The convexity of its superior surface, likewise, is no longer to be seen : the bone being rolled slightly forwards upon itself, producing a greater projection on the anterior part ; while the concavity below the clavicle at the upper and outer part of the thorax is somewhat increased. The displaced portion of the acromion is readily discovered by tracing the upper edge of the clavicle outwards, where it will be found situated on the fore and upper part of the head of the humerus, owing to the weight of the extremity. The arm hangs in close relation with the side, and the patient is unable to raise it : thus the appearances in some degree resemble those which take place in fracture of the clavicle.

CAUSES OF DISPLACEMENT.

When this fracture takes place, the loose portion of the bone is drawn slightly forwards and downwards by the deltoid muscle, and is thus brought close to the head of the humerus ; its attachments to the clavicle, and likewise to the coraco-acromial ligament, limit the action of the external fibres of the deltoid. This displacement does not depend altogether upon the action of the deltoid, but likewise upon the muscles which are attached to the clavicle.

The clavicle no longer remains a fixed part, but is set at liberty in consequence of that portion of the scapula to which it is attached being broken off ; so that it will now become the bone which is acted upon, rather than a fixed point for the attachment of those muscles whose office it is to act upon the extremity or thorax. In its natural situation, the clavicle is in part supported by the acromial process of the scapula, but this connexion no longer exists. By what then is it displaced ? It is drawn downwards, in the first place, by the subclavius muscle, in the direction of the first rib ; forwards, and again downwards, being rolled upon itself by the clavicular portions of the pectoralis major and deltoid, which muscles overcome the action of the clavicular portions of the sterno-cleido-mastoideus and trapezius ; so that the acromial extremity of the clavicle will be found resting upon the coracoid process. The scapula takes nearly the same situation as that described in fracture of the clavicle, the superior angle being raised by the levator scapulæ, while the glenoid cavity is depressed by the weight of the extremity, the pectoralis minor, and latissimus dorsi.

TREATMENT.

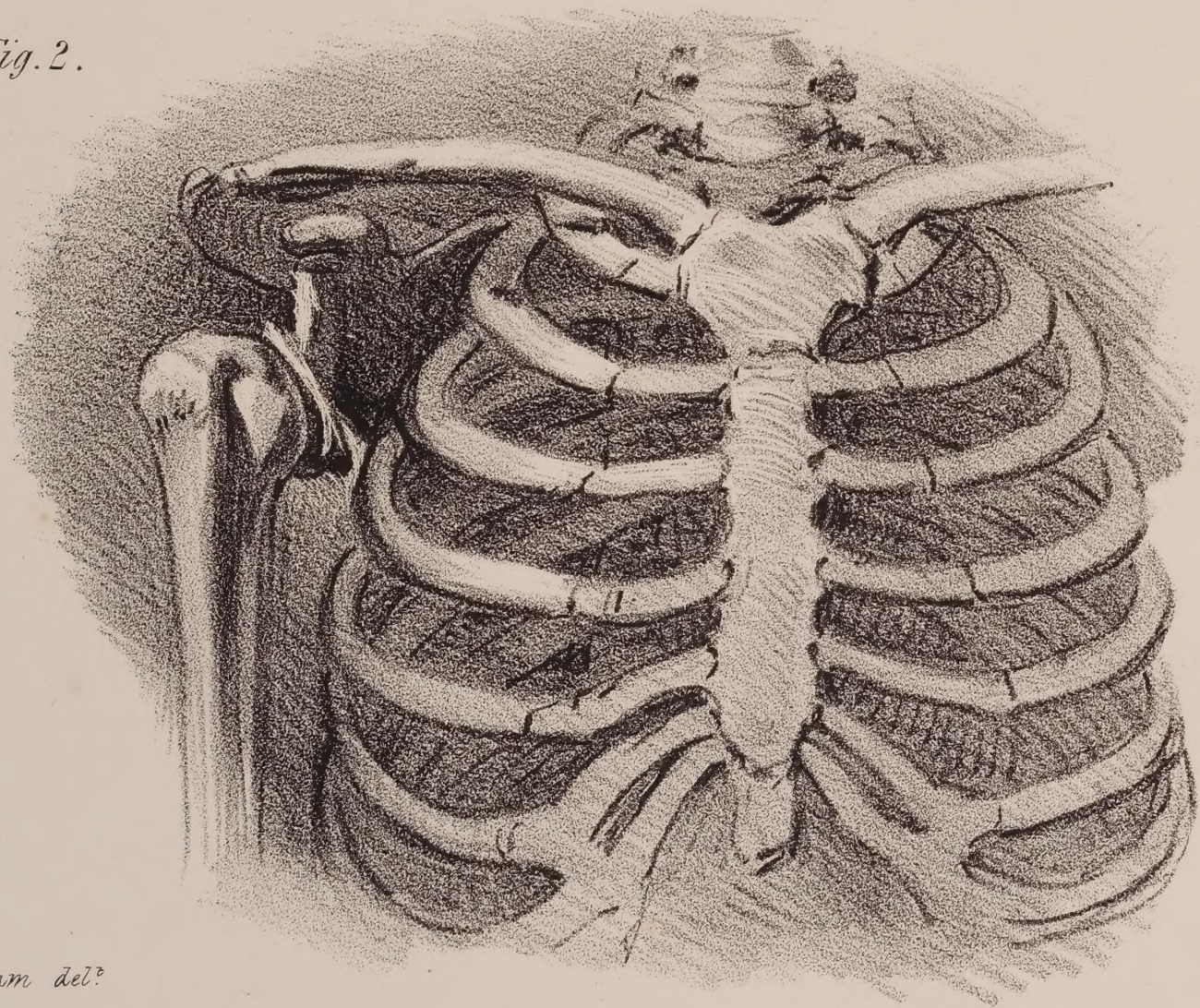
The treatment necessary in this fracture is nearly the same as in that of the coracoid process. The fracture may be readily discovered by tracing with the finger the spine of the scapula towards the clavicle, when the loose portion is detected. One hand being placed firmly on the shoulder, and the arm at the same time raised and rotated by the other hand, the crepitus is distinctly felt. The principal object in the treatment is, to bring the arm forwards over the chest, where it should be firmly fixed; by which means the portions of the pectoralis major and deltoid muscles, the latter of which is attached to the end of the acromion process, and the former to the anterior surface of the clavicle, are relaxed; the clavicle then resumes its natural situation.

The humerus should now be pushed up firmly against the scapula, for the purpose of raising the coraco-acromial ligament, and with it necessarily the detached portion of the acromion process. A bandage should be passed over the shoulder, and carried down under the fore-arm; by which means the head of the humerus will be firmly fixed under the acromion process, and will lift it to its natural level. A spica bandage should now be applied, the folds being turned over the injured shoulder; in this way the spine of the scapula will be depressed, and the broken surfaces held in contact. The motion of the arm should be entirely restrained for at least six weeks, as union by bone may otherwise be prevented: indeed, notwithstanding all our care, there is great probability of union by mere ligament taking place.

Fig. 1.

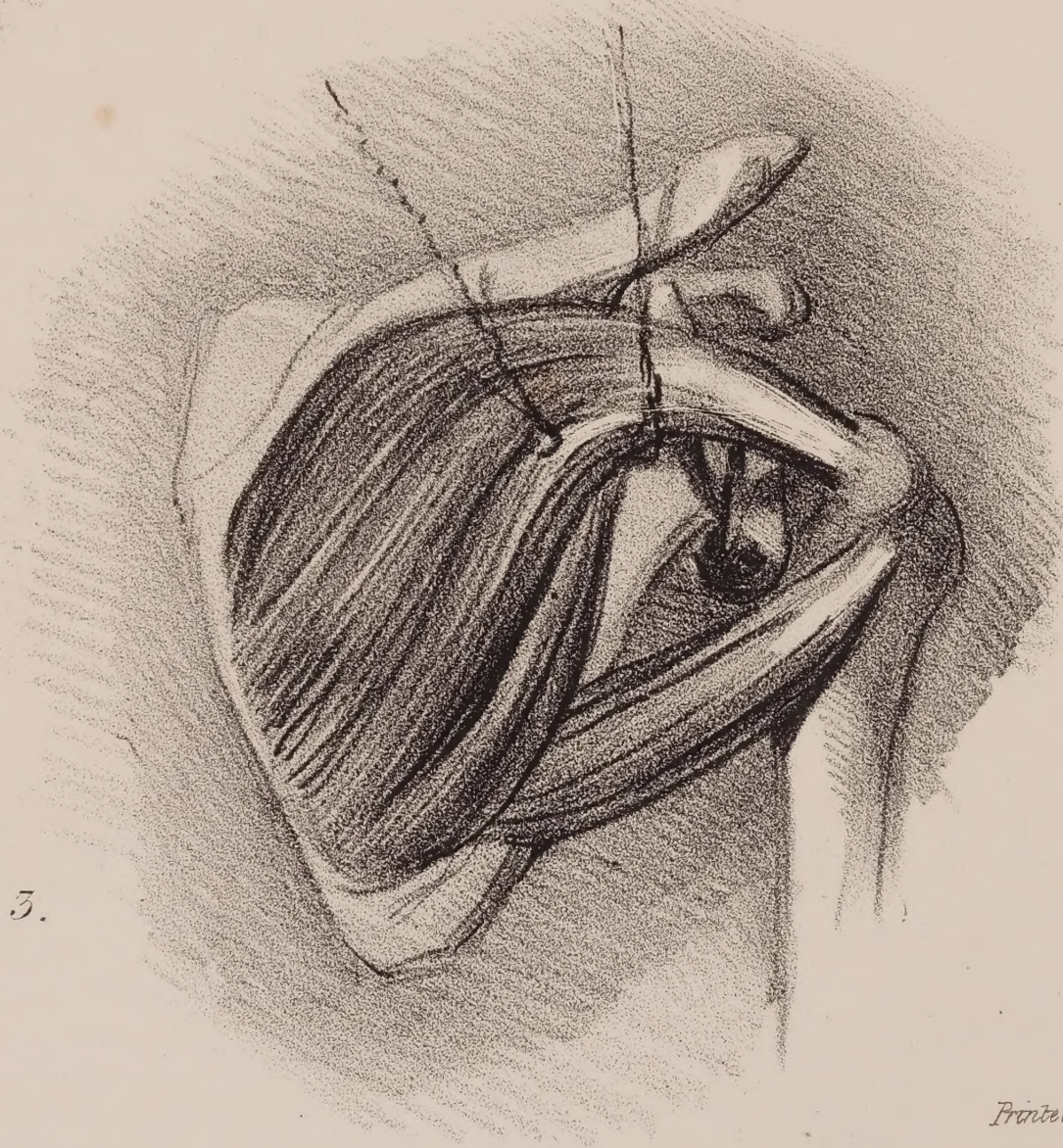


Fig. 2.



Frederick Tatham del.

Fig. 3.



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PLATE IV.

FRACTURE OF THE NECK OF THE SCAPULA.

FIG. I.

- | | | |
|-------|---|---|
| A. A. | The fractured surfaces of the neck of the Scapula. | the two cut surfaces is caused by the removal of a |
| B. B. | The detached Glenoid cavity. | portion of the muscle. |
| C. | Coracoid process. | J. |
| D. | Acromion process. | Tendon of the long head of the Biceps. |
| E. | Superior angle of the Scapula. | K. K. |
| F. | Inferior angle of the Scapula. | Long head of the Triceps muscle. |
| G. | Great tuberosity on the head of the Humerus. | L. |
| H. H. | Supra-spinatus muscle. | Teres major. |
| I. I. | Subscapularis muscle: the interval existing between | M. |
| | | Latissimus dorsi. |
| | | N. |
| | | Pectoralis major reflected. |
| | | O. |
| | | Part of the Deltoid muscle, the Clavicular portion having |
| | | been removed. |

FIG. II.

Represents the head of the bone and detached portion of the Scapula in its new relation to the Thorax.

FIG. III.

Represents the Infra-spinatus and Teres minor; the situation of the loose portion of the Scapula is likewise seen from behind.

CAUSES OF FRACTURE.

This injury is of rare occurrence; and arises from violence applied directly to the part, or transmitted through the humerus. It may take place either immediately opposite the notch on the superior costa at the root of the coracoid process, or, as represented in the accompanying plan, near the margin of the glenoid cavity: indeed, it occasionally happens that the glenoid cavity is only in part detached, in which case no apparent displacement occurs.

APPEARANCES.

When the neck of the scapula is broken off in the manner here shown, the appearances presented would in some degree correspond with those which occur in dislocation of the head of the humerus into the axilla. The acromion process becomes distinct, the point projecting as in dislocation; below this, a flatness may be observed, in consequence of the head of the bone having fallen below its proper level: the head of the bone may even be felt in the axilla, though not fully occupying it, and it can be easily raised and placed in its natural position; it is when the shoulder is thus raised that the crepitus can alone be distinctly perceived.

CAUSES OF DISPLACEMENT.

The causes of displacement depend principally on the weight of the extremity drawing down the loose portion of the scapula; for, this portion being detached, the humerus loses its means of support. It will be remembered, that to the upper edge of the glenoid cavity there is attached the long head of the biceps muscle, and to the lower surface we have attached the long head of the triceps muscle, so that the loose portion of the bone is held in close relation with the head of the humerus; consequently, whatever direction the humerus takes, the glenoid cavity will follow it. Independently of the depression of the head of the bone, it will be found to have changed its position, having turned upon its axis. A line drawn perpendicularly to the centre of the articulating surface of the humerus; in the natural situation, would look obliquely inwards and upwards; but now, in its altered position, it would look obliquely backwards and upwards. The great tuberosity is necessarily directed forwards: this arises from the actions

of the subscapularis and pectoralis major. The head of the bone is drawn into the axilla against the upper part of the inferior costa of the scapula, by the combined actions of the two last-named muscles, together with the latissimus dorsi, teres major and minor, and supra and infra spinatus.

The nature of the accident will be at once evident by placing the hand over the acromion process, the fingers grasping the shoulder firmly: by now raising the arm, at the same time that it is drawn outwards, the rotundity of the shoulder is immediately restored; and by rotating while in the raised position, the crepitus will be distinctly felt. The support being removed, the arm falls, and the shoulder again presents the appearance already described. In the dislocation, the head of the bone is fixed and the same force which raises the head in fracture, must be greatly increased, and differently applied, in dislocation. Should the fracture have taken place on a line with the coracoid notch, the appearances would be the same as in the situation here shown; for, independently of the attachments of the coraco-brachialis, pectoralis minor, and short head of the biceps, it would be supported by the coraco-acromial ligament. The fracture above described is also limited in its displacement by the coraco-humeral ligament.

TREATMENT.

The treatment in this case consists in placing a soft pad in the axilla, by which means the head of the bone and glenoid cavity are forced outwards, so that the actions of the subscapularis, pectoralis major, latissimus dorsi, supra and infra spinatus, teres major and minor, are counteracted: the humerus should now be pushed upwards, the pad in the axilla being fixed either by the figure of ∞ bandage, or the clavicle bandage of Sir A. Cooper. In raising the head of the humerus, the glenoid cavity necessarily moves with and retains its natural relation to it; for the tendon of the long head of the biceps passing directly over the head of the bone acts as a splint, by which means its relation is preserved; otherwise, the irregularities of the broken surfaces might cause permanent displacement. The arm should now be bound from the elbow to the shoulder, by passing a double-headed roller from the fore-arm near the elbow, bringing either end over the spine of the scapula, where they should cross, and again carrying them down to the chest on the opposite side; by which means the head of the bone is retained in its natural position: the two ends now being brought round to the injured side, and the arm fixed, (the fore-arm being flexed at a right angle with the arm, and supported with a short sling,) the biceps muscle is relaxed, and the loose portion remains in its natural position.

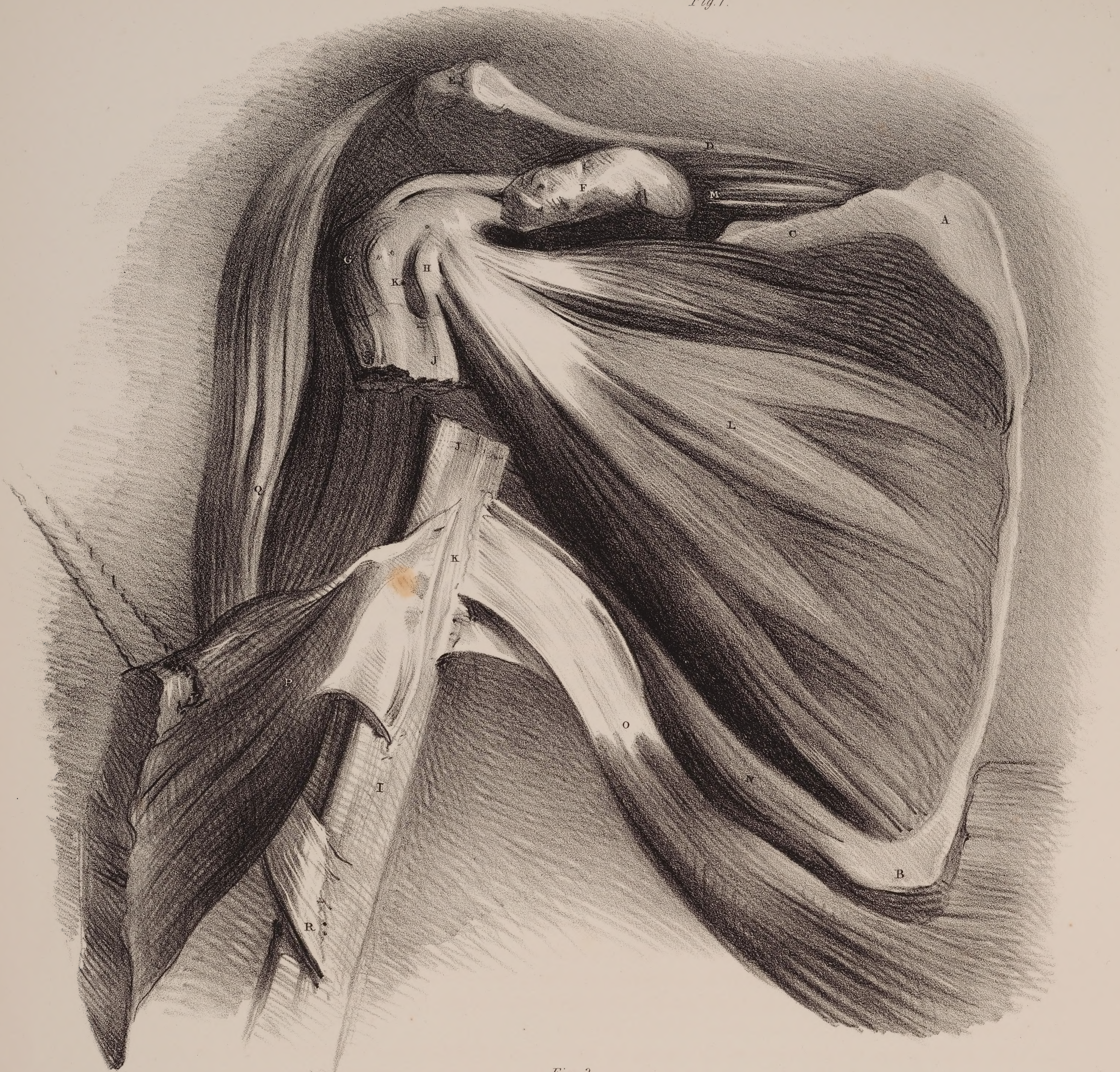


Fig. 2.



Fred^d Tatham del^t

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PLATE V.

FRACTURE OF THE NECK OF THE HUMERUS;

i. e. immediately below the tubercles and above the insertions of the Pectoralis major, Latissimus dorsi, and Teres major, muscles.

FIG. I.

- | | |
|--------------------------------------|---|
| A. Superior angle of the Scapula. | J. J. The broken surfaces of the two portions of the Humerus. |
| B. Inferior angle of the Scapula. | K. K. Bicipital groove. |
| C. Superior costa of the Scapula. | L. Subscapularis muscle. |
| D. Spine of the Scapula. | M. Supra-spinatus muscle. |
| E. Acromion process. | N. Teres major. |
| F. Coracoid process. | O. Latissimus dorsi. |
| G. Great tuberosity of the Humerus. | P. Pectoralis major reflected. |
| H. Lesser tuberosity of the Humerus. | Q. Part of the Deltoid muscle. |
| I. Shaft of Humerus displaced. | R. The insertion of the Deltoid. |

FIG. II.—POSTERIOR VIEW OF THE SCAPULA.

- | | |
|--------------------|-----------------|
| S. Infra-spinatus. | T. Teres minor. |
|--------------------|-----------------|

CAUSES OF FRACTURE.

This accident may occur from violence applied directly on the part, or to the lower extremity of the bone, as by a fall.

APPEARANCES.

The appearances presented in this fracture agree somewhat with those which occur in dislocation of the head of the humerus from the glenoid cavity into the axilla. The position of the arm, taken generally, may be said to accord in both cases; but, upon more particular examination, the true nature of the accident will be at once evident.

In fracture of the neck of the humerus, the elbow is drawn away from the side, while the upper portion of the shaft below the situation of the fracture appears to rest against the side of the chest, as in dislocation into the axilla; the patient is incapable of raising the hand to the head, and when such a request is made by the surgeon, the head rather is brought down to the hand: this inability is explained by the bone having lost the fulcrum upon which it moves.

The appearances of the shoulder will alone, as far as we can judge by observation, satisfy us with regard to our diagnosis. When dislocation of the shoulder has taken place, the acromion process becomes prominent, and even distinct to the eye, and a general flatness of the surface is the consequence, from the removal of the head of the bone, which ought to occupy the space; the deltoid muscle then falling across the glenoid cavity and occupying it.

In fracture we find the reverse: the shoulder presents an increased rotundity, but in a trifling degree; the acromion process becomes more concealed than in the natural situation of the parts, in consequence of the head of the bone being drawn upwards against the ligament above it, by which means a slight elevation takes place on the superior part, thus producing the rotundity; and this rotundity is rendered more conspicuous by a depression immediately below the level of the glenoid cavity of the scapula, from the lower portion of the humerus being drawn inwards, while the upper remains nearly in its usual position, as before stated, viz. slightly raised.

CAUSES OF DISPLACEMENT.

In reference to the plate, the fracture will be observed as described above; the portion above the fracture (to which we have attached, on the anterior part at the lesser tubercle, the subscapularis muscle,

while, on the outer part of the greater tubercle, is attached the supra-spinatus, and to the posterior part of the same tubercle the infra-spinatus and teres minor,) will be drawn slightly upwards, immediately under the coraco-acromial ligament; not outwards, for the action of the supra-spinatus is overcome by the subscapularis on the anterior part, and the teres minor and infra-spinatus muscles on the back part; so that the bone is simply raised above its usual level: and if we examine the relative sizes of these four muscles, enumerated above as being inserted into the tubercles of the head of the bone, we shall at once perceive how insignificant would be the power of the supra-spinatus compared with the remaining three, whose actions counteracting nearly the powers of each other, (the posterior ones rather preponderating,) entirely destroy any visible effect by the supra-spinatus, with the exception that it (the head of the bone) is slightly raised.

The upper extremity, viz. the broken end of the lower portion of the bone, will be found drawn inwards, producing an evident concavity at this point; and probably it is this circumstance which has led to the idea that the upper portion is drawn outwards, which would be at variance with the natural actions of the muscles; the concavity, or depression, rendering the natural convexity of the shoulder more prominent to appearance merely by the contrast. The elbow is at the same time separated from the side. By reference to the plate, we find inserted to the upper extremity of the lower portion of the bone the pectoralis major, latissimus dorsi, and teres major; the former into the outer edge of the bicipital groove, the two latter into the inner edge of the same groove; the combined action of which three muscles is to draw the upper extremity of the lower fractured portion towards the side of the thorax, where it is held, so that, whatever action takes place, the bone now moves on this point as the fulcrum.

Below the insertion of the three last-mentioned muscles, to about the middle of the outer part of the humerus, we find inserted the deltoid muscle, whose action draws the humerus from the side; but being fixed by the pectoralis major, latissimus dorsi, and teres major, at its upper extremity, and moving on this point as its centre, the insertion of these muscles being the fulcrum, the lower end of the humerus consequently by its action takes an oblique direction outwards.

TREATMENT.

The accompanying plate will perhaps suggest what should be the plan of treatment in this fracture; the displacement altogether arising from the actions of the powerful muscles inserted into the humerus. The lower portion of the bone is here that which suffers the greatest degree of displacement, in consequence of the attachments of the pectoralis major, latissimus dorsi, and teres major muscles drawing it towards the thorax, while the deltoid directs the elbow outwards: this deformity is easily reduced by fixing the shoulder, and at the same time drawing the arm outwards and downwards, when the crepitus is distinctly felt; upon the removal of the force the original deformity is immediately resumed.

So trifling is the displacement of the head of the bone, that little or no deformity occurs at the shoulder.

The plan that would immediately suggest itself for the reduction and final position of the limb, would be that which is usually adopted. The arm should be slightly extended, and at the same time drawn from the side: in this position, the common lath or pasteboard splints are to be applied at four sides of the arm, and there held firmly by a cotton roller; a firm conical pad may now be placed between the upper part of the bone and the thorax, the base of which must occupy the axilla, the apex pointing downwards, and slightly hollowed out for the reception of the arm; they are to be firmly bound together, taking care that the conical compress is firmly fixed to the side of the chest: in this way the elbow is approximated to the side, and adapted to the oblique surface of the compress. By this means the action of the deltoid muscle is counteracted; while the base of the pad or compress, which is above, counteracts the actions of the pectoralis major, latissimus dorsi, and teres major, muscles: by thus forcing the humerus from the side, the lower fractured portion is firmly fixed with its broken surface looking directly upwards.

All that now remains to be done is to depress the superior portion of the bone, consequently bringing the fractured surfaces of the bone in contact: this is accomplished by means of a cotton roller passed over the shoulder and carried under the apex of the conical pad; so supporting the whole extremity, and preventing the weight of the arm from separating the fractured surfaces. In this manner the whole of the muscles producing the various displacements of the bone are counteracted. The fore-arm should now be bent at a right angle, and supported in a sling.



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PLATE VI.

FRACTURE OF THE SHAFT OF THE HUMERUS

Between the insertions of the Pectoralis major, Latissimus dorsi, and Teres major, and above the insertion of the Deltoid.

FIG. I.

- | | |
|-------------------------------------|---|
| A. Superior angle of the Scapula. | J. J. The fractured surfaces of the bone. |
| B. Inferior angle. | K. Bicipital groove. |
| C. Superior costa. | L. Subscapularis muscle. |
| D. Spine of the Scapula. | M. Supra-spinatus fossa. |
| E. Acromion process. | N. Teres major. |
| F. Coracoid process. | O. Latissimus dorsi. |
| G. Great tuberosity of the Humerus. | P. Pectoralis major reflected. |
| H. Lesser tuberosity. | Q. Deltoid muscle. |
| I. Shaft of the Humerus. | R. Insertion of the Deltoid. |

FIG. II. — POSTERIOR VIEW OF THE SCAPULA.

- | | |
|--------------------|-----------------|
| S. Infra-spinatus. | T. Teres minor. |
|--------------------|-----------------|

CAUSES OF FRACTURE.

The causes of this fracture are violence applied directly to the part, or a fall upon the elbow.

APPEARANCES.

In this fracture, the position of the two portions of the bone is precisely the reverse of what are described as found in the foregoing. The fracture has taken place immediately below the insertion of the teres major, latissimus dorsi, and pectoralis major, and above the insertion of the deltoid. The deformity consequent upon this fracture consists in a slight shortening of the limb, in consequence of the lower portion being drawn upwards; while at the same time a prominence is observed about the middle of the outer part of the arm, immediately above the insertion of the deltoid: from the projection of the broken end of the lower portion riding over the upper, the width of the arm is considerably increased, and the elbow is directed, but in a very slight degree, towards the chest: these circumstances at once indicate the nature of the accident, which occurs from direct violence applied to the part, either by a fall or blow.

CAUSES OF DISPLACEMENT.

The upper portion of the bone is here found drawn to the side of the thorax by the united actions of the pectoralis major, latissimus dorsi, and teres major, and is held in this position; while the lower portion is pulled outwards, and slightly upwards, by the action of the deltoid muscle, which is inserted into the upper extremity of the lower portion of the fractured bone, so that it takes rather an oblique direction, the elbow inclining to the side; the obliquity is trifling, but may be readily observed. Little or no displacement occurs in the direction from before backwards; for the bone is so clothed on the anterior and posterior surfaces, before by the brachialis anticus and biceps, and behind by the fleshy triceps, that they counteract each other. If the fracture takes place in an oblique direction, then the deformity would be much greater, and dependent altogether upon circumstances which will be explained in the description of the following plate

TREATMENT.

The treatment in this fracture is rendered simple in consequence of the comparatively few muscles producing the deformity.

It will be observed, in reference to the plate, that the upper portion is displaced (drawn inwards) by the pectoralis major, latissimus dorsi, and teres major, while the lower portion is drawn outwards and upwards by the deltoid alone; to this portion our attention should be first directed. The two portions of the bone should in the first place be brought into apposition in the following manner: extension should be applied at the elbow, giving to it at the same time a direction correspondent with the upper portion; a roller should then be applied, as usual, from the bend of the elbow, commencing at the upper part of the fore-arm. This being done, four lath splints, well lined with tow, should be applied, one on either surface of the arm; thus holding the two portions of the bone in contact. A conical pad, as in the last fracture, should now be placed between the upper portion and the thorax, for the purpose of directing it outwards: this being well secured, the splints may now be bound to the arm by a firm cotton roller, taking care that the fore-arm is bent at a right angle with the arm, and thus supported: the whole may now be firmly bound to the side of the conical pad, as in the last-described fracture: thus the muscles displacing both the upper and lower portions will be counteracted, and the broken surfaces brought in apposition and secured in their natural situations.



Fred^d Tatham del^d

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PLATE VII.

FRACTURE OF THE SHAFT OF THE HUMERUS

Immediately below the insertion of the Deltoid muscle.

- | | |
|--|----------------------------------|
| A. A. Two surfaces of the Os humeri fractured. | E. Brachialis anticus. |
| B. Radius. | F. Biceps flexor cubiti. |
| C. Ulna. | G. Deltoid muscle. |
| D. Triceps extensor cubiti. | H. Part of the Pectoralis major. |

CAUSES OF FRACTURE.

This injury takes place, either from a fall upon the elbow, or a blow immediately upon the part. The oblique fracture is generally the result of the former means; the transverse is the consequence of the latter.

APPEARANCES AND CAUSES OF DISPLACEMENT.

The deformity that succeeds fracture in this part of the humerus depends entirely upon the nature of the fracture, whether it be simply transverse, or in an oblique direction. When transverse fracture of this bone takes place below the insertion of the deltoid, little deformity occurs beyond a slight projection forwards of the upper extremity of the lower portion, and then only under certain circumstances. The shortening of the limb is scarcely visible. The incapacity of the patient to use or raise the arm need hardly be enumerated as a symptom; and even the projection forwards of this portion does not depend upon muscular action, but takes place from the mechanical force that has been applied. The humerus, at this situation, it will be remembered, is firmly clothed on the anterior part by the brachialis anticus and biceps, and on the back part by the triceps muscle: these antagonise each other, so that their natural action would be to draw the broken surfaces in close contact; but the force necessary to produce the fracture would occasionally, if applied with great violence, give the lower portion a direction corresponding with the direction of the force applied. Independently of this, we should take into consideration the weight and long lever power of the fore-arm, which, when unsupported, would descend by its own gravity; and the fore-arm descending would draw with it the lower portion of the bone, by means of the muscular connexion existing between them, moving on the elbow as the centre. The fore-arm, in fracture, we find always supported by the patient, and from this circumstance no displacement occurs in the transverse fracture; but when this support is removed, as when the surgeon is about to make examination, then the slight falling forwards, as described above, of the lower portion takes place, simply from the alteration in the position of the fore-arm.

When the fracture takes place obliquely, the circumstances altogether differ. In reference to the accompanying plate, the fracture is observed to incline from above downwards and backwards, the two surfaces in this instance gliding easily over each other by the combined actions of the biceps and brachialis anticus on the anterior part, and by the triceps muscle on the posterior; so that the appearances in oblique fracture, in this situation, are a shortening of the limb, with evident increase in its circumference at the point of fracture, with the broken surfaces of the bone protruding the soft parts. The causes of displacement must be at once clear and simple, dependent altogether on the manner of fracture.

When the bone is broken in a direction the reverse of this, the situation of the parts would likewise be reversed. In the plate, the lower portion is the most anterior, from the causes already pointed out; but should the fracture occur in the opposite direction, then it is clear, upon this principle, that the same portion (the inferior) would glide backwards, and the superior portion would be anterior to the lower portion,—the reverse of what is seen in the plate.

TREATMENT.

In this case the treatment consists simply in placing splints on either side of the arm, having first produced extension sufficient to reduce the deformity : in this situation, extension is easily made, (but requires great care to retain it,) simply by pulling the arm at the elbow ; care, however, is required in handling the extremity, particularly when the points of the broken ends of the bone are near the surface, as is not unusually the case. This extension should be continued for some time, so that the muscles, being kept constantly on the stretch, lose much of their power : in this state of the parts, a roller should be applied carefully round the arm, from the elbow ; four firm splints, lined with tow or lint, are now to be placed one on either side of the arm, and those well and firmly adjusted by means of a cotton roller ; the fore-arm is then to be supported by means of a handkerchief round the neck ; thus the broken surfaces are brought into immediate contact : much care is here requisite, for should the bandage become at all loose, the disposition of the surfaces to ride over each other should be immediately prevented by a re-adjustment of the splints and bandages.

When the fracture has taken place, and the obliquity is great, the case will present much difficulty, and may be managed more easily by the application of the splint which is described in a note after the description of the following plate.

Fig. 1.



Fig. 2.

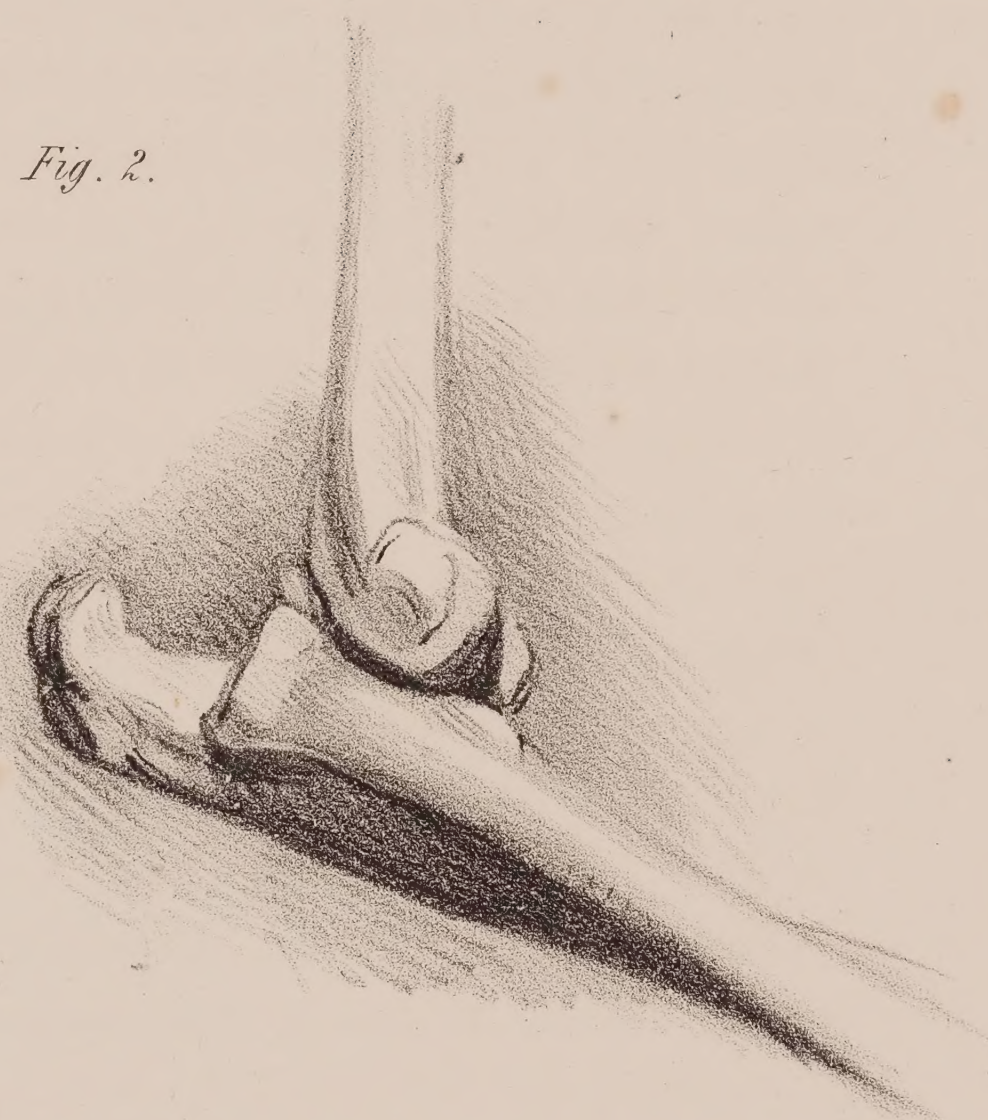


PLATE VIII.

FRACTURE OF THE HUMERUS

Immediately above the Condyles.

FIG. I.

- | | |
|--|-----------------------------|
| A. A. Broken surface of the Os humeri. | E. Biceps. |
| B. Radius. | F. Brachialis anticus. |
| C. Ulna. | G. Triceps extensor cubiti. |
| D. Deltoid muscle. | |

FIG. II.

Shows the situation of the bones in dislocation of the Radius and the Ulna backwards.

CAUSES OF FRACTURE.

This accident usually takes place from a blow or fall, the whole weight of the body falling directly upon the elbow.

This accident deserves perhaps more consideration than any of the preceding, the appearances presented so immediately corresponding with those which exist when dislocation of the radius and ulna has taken place backwards.

APPEARANCES AND CAUSES OF DISPLACEMENT.

The appearances in this fracture, where the obliquity corresponds with that represented in the drawing, (obliquity forwards and downwards,) are as follows: the limb is considerably shortened, and incapable of motion; the fore-arm, unless supported, hangs useless by the side, at the same time that an increase in the circumference takes place about the situation of the fracture; in fact, the same circumstances take place as in fracture in the situation last described, and dependent upon exactly the same cause: but from the situation of the fracture in this instance, which is immediately above the condyles of the humerus, the appearances vary; indeed it presents precisely the characters of dislocation of the ulna and radius: a reference to the accompanying plate will at once explain how this arises. The lower portion will be drawn, or will rather glide, backwards over the broken surface of the upper portion, by the combined actions of the brachialis anticus and biceps, which are situated on the anterior part, and by the triceps, which is on the posterior part; so that the lower portion is drawn about one inch behind its usual situation.

When the fore-arm is supported, as is invariably the case when the patient is first seen by the surgeon, this deformity does not take place to its fullest extent: but should the arm be allowed to fall loose, or should it be depressed by the surgeon for the purpose of examination, then it is that the deformity is fully developed; for the fore-arm carrying with it the lower portion of the humerus, it is made to project backwards; and then it is that the fears as to its being a dislocation are entertained. The increase of the deformity, however, under these circumstances, should at once satisfy the surgeon of the non-existence of dislocation; for when the dislocation referred to has taken place, the act of extending the fore-arm would in some degree diminish the deformity.

Should the fracture have taken place in the opposite direction, but in the same situation, no such deformity occurs: the appearances then would be as follows; the point of the broken surface of the upper portion would project through the integument, were it not that the strong tendon of the triceps muscle protected it. The prominence would now take place on the anterior part; but the displacement is then readily distinguished as fracture, from the broken surface posteriorly being distinct both to the eye and to the touch.

The reduction of the bones requires considerable force, and cannot be perfectly effected till all tumefaction, is subdued. The hand being placed near the elbow on the fore-arm at the same time that the shoulder is supported, extension is now produced, and the deformity disappears; but immediately this force is removed, the displacement instantly returns.

TREATMENT.

The treatment in this case is by no means simple, and requires considerable care, in consequence of the difficulty experienced in applying splints so as to keep up the extension, and from the disposition of the surfaces to ride over each other. When the fracture takes place above this point, there is ample room for the firm application of splints; but here the distance being so small below the fracture to the elbow, there is no firm hold by which they can be fixed. The plan usually adopted is, to apply a roller from the hand to the elbow: an assistant now produces extension, the bones being held in apposition and the fore-arm fixed with the thumb upwards, so that it is now in the state between pronation and supination; by which means the muscles of the fore-arm attached to the humerus are relaxed, and the bone freed from their action: the roller is carried round the arm to the shoulder. The angular splint should at this stage be applied to the inner side of the arm, having been previously well padded with tow, and at present fixed firmly to the fore-arm only by means of a cotton bandage; so that the perpendicular portion of the splint is adapted to the inner side of the arm, while the horizontal portion is applied to the palmar surface of the fore-arm. Extension is again produced, until the broken surfaces are brought into immediate relation, where they are held: the bandage is now to be firmly applied around the splint and carried up to the shoulder. In this way the extension is best continued; but from the peculiar situation of the fracture, the disposition to displacement will require the frequent re-adjustment of the apparatus. The advantage derived by the use of the angular splint is, its effectually supporting the fore-arm; the weight of which, acting now perpendicularly on the lower portion of the humerus, assists in some degree in drawing it down.

NOTE.

The author begs to offer the following drawing of a splint, which has been found to answer the desired end in the fracture just shown, and may likewise be serviceable in the treatment of that shown at pl. vii. where the fracture is oblique. The difficulty in the treatment of both these fractures requires means more convenient than even the angular splint, which is now in common use. In the case alluded to, this apparatus was applied subsequent to the adjustment of the parts by means of softened pasteboards and bandages. The plan is taken from a splint intended for the right arm, is applied to the inner side, and when strapped on, the extremity having been thickly covered with bandages, and the splint likewise well padded with tow, the extension should be produced.

a, A crutch-like pad to fit into the axilla. *b*, the upper part of the splint, which slides into the lower part *c*, and is moveable by means of the screw *d*, by which it may be either elongated or shortened: *e e*, is a bar by which the perpendicular motion of the sliding part is preserved. The part of the splint adapted to the fore-arm is seen at *f*, which folds over the upper part, so that the extension is made by pressing generally on that part of the limb; this part of the apparatus moves at *g*, and allows passive motion, when necessary, by withdrawing the pin *h*, from the hole into which it fits at *i*; the position of the fore-arm may be regulated at any angle by means of a series of holes at the joint in the under plate, and may be there fixed by the pin *h*. *j j*, two straps for the purpose of fixing the splint to the arm. *k k*, straps by which the horizontal part is fixed to the fore-arm.

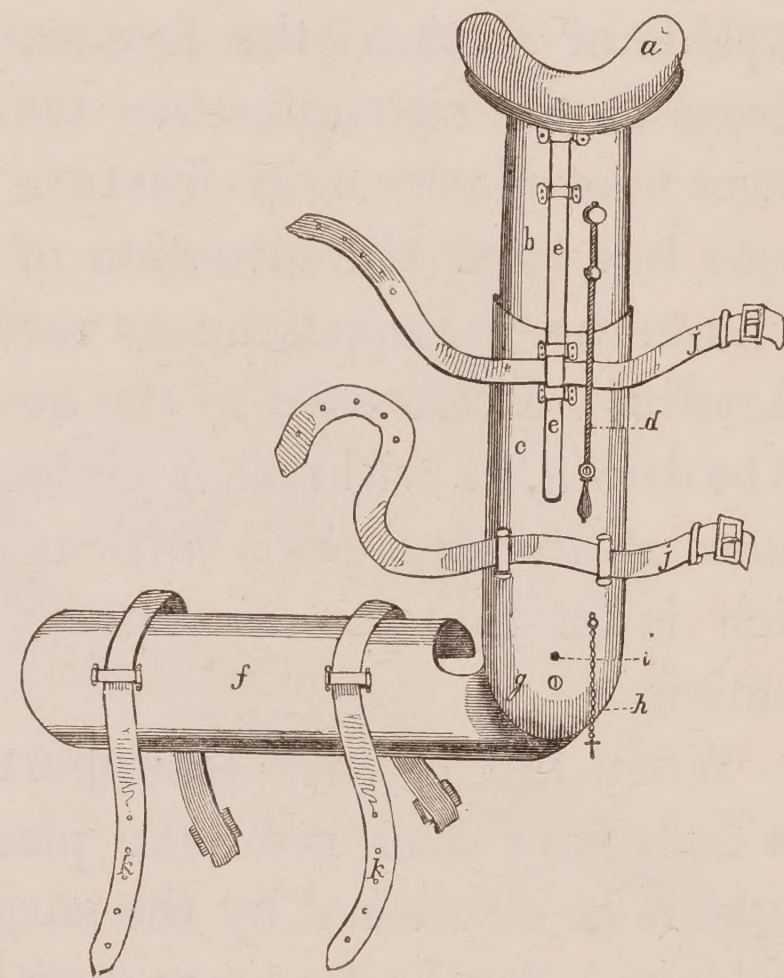


Plate 9.

Fig. 1.

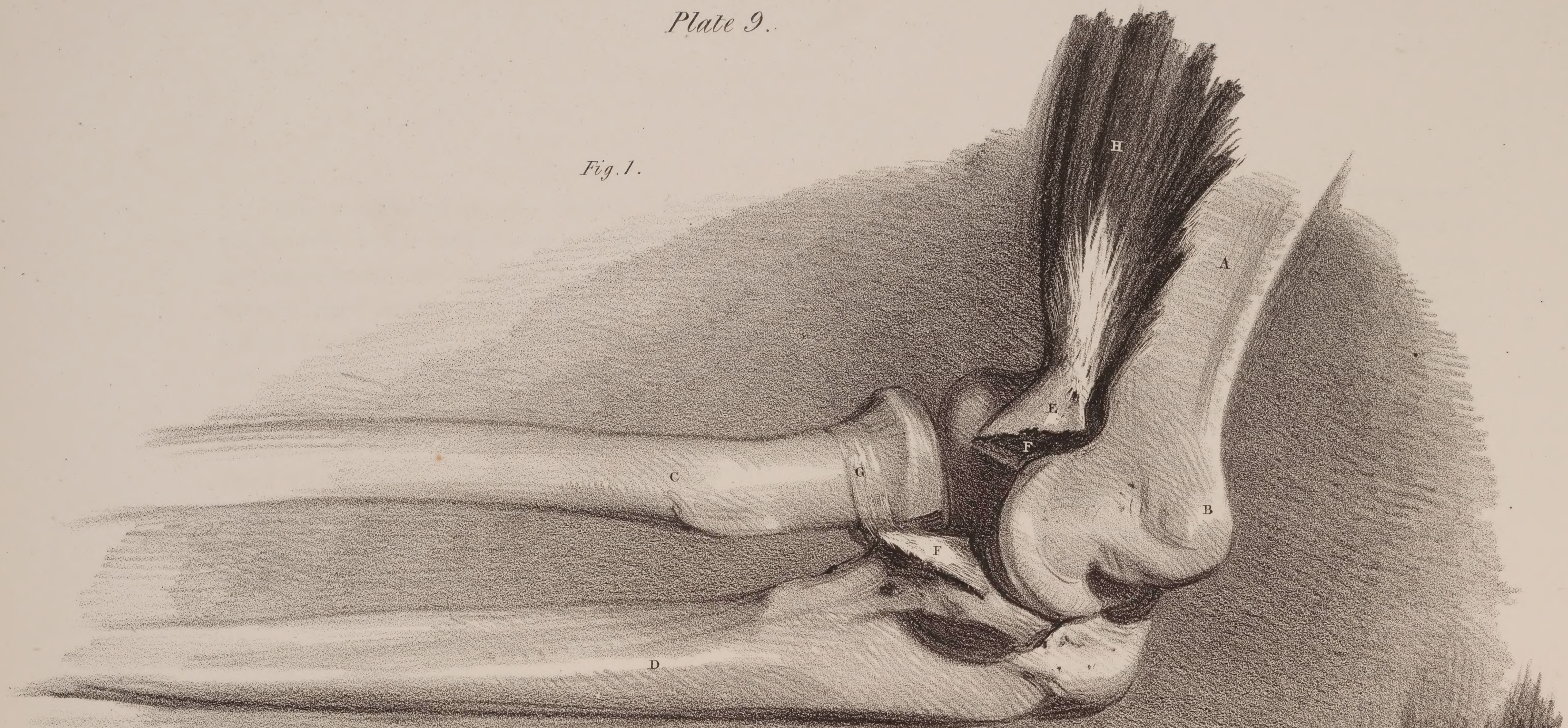
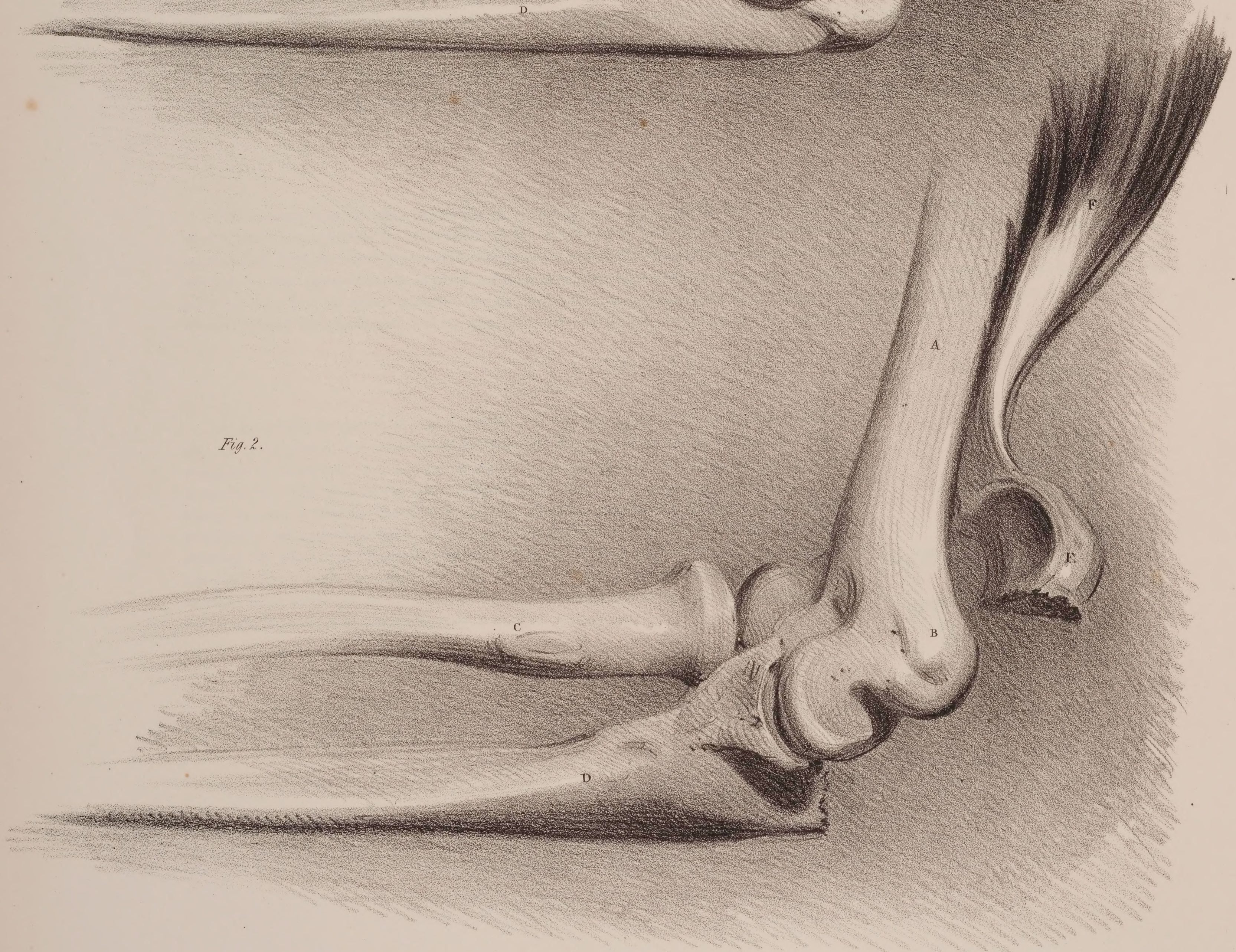


Fig. 2.



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London, John Taylor, Upper Gower S.^c

PLATE IX.

FIG. I.

FRACTURE OF THE CORONOID PROCESS OF THE ULNA.

- | | |
|-------------------------------------|---|
| A. Shaft of the Humerus. | E. Detached Coronoid process of the Ulna. |
| B. Internal Condyle of the Humerus. | F. F. Broken surfaces. |
| C. Radius. | G. Annular ligament of the Radius. |
| D. Ulna. | H. Brachialis anticus muscle. |

CAUSES OF FRACTURE.

This accident is much less frequent in occurrence than the preceding, and takes place from the inordinate action of the muscle attached to its superior surface.

APPEARANCES AND CAUSES OF DISPLACEMENT.

The appearances which characterise this accident vary considerably. Should the tip merely be broken off, the loose portion will be drawn upwards, either on a level with, or above, the coronoid fossa of the humerus. The tendon of the biceps muscle becomes prominent, forming an elevated ridge in the centre of the bend of the arm, in consequence of the falling in of the integument on either side, by the removal of the brachialis anticus and coronoid process from below it: the act of flexion is in part lost, so that the patient, when the arm is extended, has but a limited power in raising it. The loose portion of the bone, when the arm is flexed, may be readily felt below the upper part of the tendon of the biceps muscle.

The sole displacing muscle in this fracture is the brachialis anticus, which is attached directly to the upper part of the process.

Should the fracture take place near or at the root of the process, the case becomes more complicated, for then the ulna in the extended position of the fore-arm is drawn backwards and subluxated by the action of the triceps muscle; but this displacement is immediately reduced by flexing the fore-arm: neither is the dislocation complete, for it is held nearly in its natural situation by the ligamentous connexion with the radius, which ligament surrounds the neck, and is attached to either edge of the lesser sigmoid cavity of the ulna.

The fracture may likewise take place so low down that the attachment of the anterior extremity of the annular ligament of the radius becomes either lacerated or pulled upwards; in which case the radius suffers displacement, by the action of the biceps muscle drawing it upwards: these cases, however, come more immediately under the head of dislocation, and will be given fully at a future period.

TREATMENT.

The treatment recommended in this fracture consists in flexing the fore-arm; in which position the ulna is brought upwards, nearly in contact with the detached portion: a bandage should be applied firmly round the arm, commencing at the shoulder and carried downwards to the elbow; by this means the brachialis anticus muscle is relaxed, the displaced portion brought downwards, and the broken surfaces retained in apposition. The fore-arm, being flexed to the utmost, should now with the arm be firmly bound to the side of the chest.

The union of this fracture, in the few cases related, has been generally ligamentous.

FIG. II.

FRACTURE OF THE OLECRANON PROCESS OF THE ULNA.

- | | |
|-------------------------------------|--------------------------------|
| A. Shaft of the Humerus. | D. Ulna. |
| B. Internal Condyle of the Humerus. | E. Detached Olecranon process. |
| C. Radius. | F. Triceps extensor cubiti. |

CAUSES OF FRACTURE.

The olecranon process is occasionally broken by the inordinate action of the triceps muscle, but more frequently takes place from a blow or fall directly upon the point of the elbow.

APPEARANCES.

The accident is characterised by the following appearances :—In addition to the ordinary pain and swelling, the olecranon process is drawn upwards, the prominence of the elbow is lost, and a considerable depression is found at the posterior part. The circumference of the arm is increased by the contraction of the triceps: the patient loses the power of extending the arm at will; and when it is extended, which takes place from the relaxation of the biceps and brachialis anticus, the arm falls by its own weight. The hollow at the posterior part is then considerably diminished; but, when flexed, the depression is much increased, and takes place to its fullest extent.

In reference to the plate, the fracture is observed to have taken place about the centre of the concave articulating surface (the sigmoid cavity), which is the weakest part of the process. Should the arm be flexed during the fall or blow, the displacement and injury done would be more considerable than when the accident occurred in the nearly extended condition; for in this case the contraction of the triceps would take place with much more violence, and to a much greater extent: the accident occurring then in this position of the fore-arm, the surrounding parts suffer much more injury; the strong ligamentous connexions of the joint are lacerated and contused by the violent action of the muscle, independently of the contusion arising immediately from the force applied from without: under these circumstances, the broken portion is drawn upwards to a greater extent than were it broken with less violence.

CAUSES OF DISPLACEMENT.

The displacement is occasioned solely by the action of the triceps drawing up with it the detached portion; but even here it will be limited in its extent of displacement, according to the situation of the fracture. Should the tip of the process merely be broken, the portion of the bone will be drawn up much above the level of that fracture which takes place at the root; for when it is broken through at the root, the firm ligamentous fibres, viz. those of the lateral and posterior ligaments, prevent it suffering any considerable degree of displacement; so that by simply extending the arm, the surfaces are brought into immediate contact, without the necessity of any means for drawing down the loose portion: but should the force under these circumstances have been considerable, these firm ligamentous connexions are broken through, and the displacement then becomes as distinct as in the other fracture. Where the fracture has occurred nearer the extremity, extension of the fore-arm will not bring the surfaces together; the loose portion must be drawn down, when the crepitus is felt. This fracture resembles very much that of the patella, occurring in the same way, requiring the same treatment, and uniting, as it does, generally by ligament.

TREATMENT.

The treatment in this fracture consists simply in extending the arm, by which means the broken surface of the shaft of the ulna is brought nearer to the displaced portion. By now placing the hand above the olecranon, it may be brought down, thus approximating the two surfaces: when moving the loose portion laterally, the crepitus is distinctly felt. A broad cotton roller should now be applied round the upper part of the fore-arm; this should be fixed firmly: it would be even more secure, were this bandage to commence at the hand, and be carried upwards to near the situation of the fracture. Another bandage should now be applied immediately above the displaced portion (the olecranon process); two pieces of a strong roller should now be passed under both bandages, viz. that which is above and that below the fracture, one on either side of the olecranon. The ends of either of these portions on the corresponding sides should now be tied together, thus bringing the olecranon downwards against the broken surface of the shaft of the ulna: this done, a firm splint, lined with tow or lint, extending in nearly the whole length of the arm, should be applied on the anterior part, which should be firmly secured; the fore-arm being at the same time fully extended, by carrying a roller from the hand upwards to near the elbow. Another bandage should now be applied above the displaced portion, commencing at the upper part of the arm, (at the axilla, which should be brought from above downwards: during the application of this, the arm should be directed backwards, for the purpose of relaxing the triceps extensor muscle; by which the muscle is prevented drawing the olecranon process from the natural situation, which it now occupies. The two strips, which include the rollers above and below the elbow, may again be brought more closely together; by which means the broken surfaces are accurately adjusted. The arm should likewise be secured to the side, and the hand directed backwards.

Fig. 1.

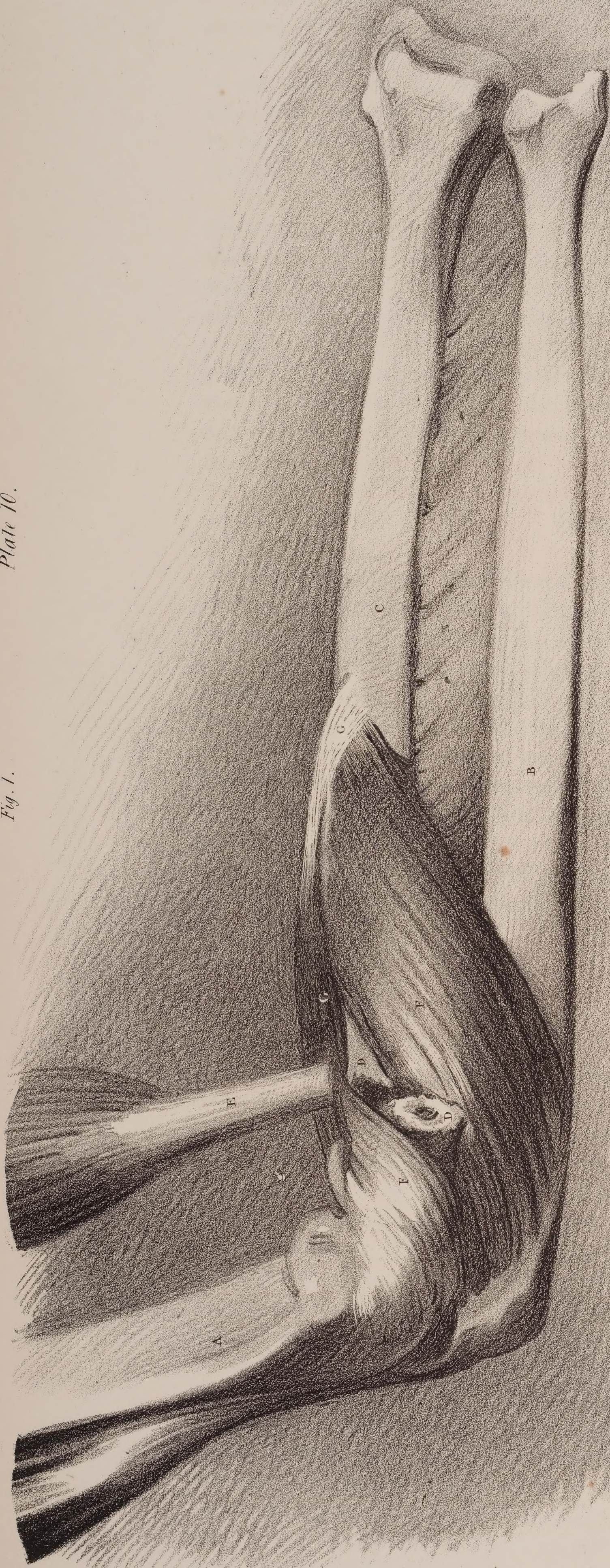


Fig. 2.



PLATE X.

FIG. I.

FRACTURE OF THE NECK OF THE RADIUS.

- | | | | |
|-------|--|-------|---|
| A. | Humerus. | F. F. | Supinator brevis, cut through to expose the |
| B. | Ulna. | | broken surface of the upper portion of |
| C. | Radius. | | the Radius. |
| D. D. | Broken surfaces of the neck of the Radius. | G. | Pronator teres muscle. |
| E. | Biceps muscle. | | |

CAUSES OF FRACTURE.

This fracture is of very rare occurrence, and has been known to have taken place from the immediate application of violence to the part by means of machinery, the arm being at the same time fixed by means of the hand grasping a bar : in this situation the radius is prominent on the outer part of the arm, and is there exposed in the greatest degree to injury applied from without.

APPEARANCES.

In the fracture of the neck of this bone, much difficulty will be found in detecting its immediate situation. The position of the arm at once indicates fracture of the radius ; for it is invariably the case, in fracture of this bone, that the fore-arm is in a state of pronation and retains this position. The motions of the fore-arm, viz. that of pronation and supination, are entirely destroyed, but the extent of pronation is not carried beyond what is natural ; (as is the case in all fractures of the radius, this only excepted :) little deformity takes place in fracture at this situation, from the circumstance of the parts being so thickly clothed and surrounded with muscles ; the only deviation that is observed is a slight fulness on the anterior and upper part of the fore-arm, attended with inability to rotate it.

CAUSES OF DISPLACEMENT.

The upper portion of the bone will be found drawn slightly outwards and downwards, but not to any considerable extent. It will be remembered, that the radius above the fracture, or even perhaps at the immediate situation of the fracture, is surrounded by the annular ligament, which prevents its displacement beyond a certain limit, unless laceration has taken place. The action of the supinator radii brevis is the sole cause of the displacement of this portion of the bone : it arises from the outer condyle of the humerus, and is inserted into the anterior part of the head and upper extremity of the radius ; its action is to rotate the radius outwards : the few fibres attached above the fracture roll the head of the bone outwards, and likewise give the broken surface the same direction. The lower portion is drawn forwards, upwards, and inwards. The biceps muscle, which is inserted into the tubercle of the radius, and consequently into the upper extremity of the lower portion, is, in the natural state of the parts, a flexor of the fore-arm through the medium of the radius : independently of this action, it likewise, under certain circumstances, becomes a supinator : the latter of these actions, when fracture has taken place at this point, is entirely lost, in consequence of the separation of the shaft from the upper fixed point upon which it moves ; the lower portion of the bone is then drawn forwards and slightly upwards by the action of the biceps, producing the fulness on the anterior part. But it must be remembered, that the oblique ligament of the radius is now on the stretch, as well as the fibres of the supinator radii brevis, which are in action : these counteract in some degree the effect of the biceps muscle. It will likewise be observed that the lower portion is drawn inwards : this displacement depends upon the action of the pronator teres, which arises from the inner condyle of the humerus, and is inserted into the middle and outer part of the radius : its action is to draw

the radius over the ulna, (to pronate the arm,) and it is consequently the cause of the displacement ; for the bone, having now no fixed point above upon which it can move, is made by its contraction to take the direction inwards. These facts account at once for the difficulty which exists in distinguishing the crepitus, for the broken surfaces look in opposite directions ; the upper being directed downwards and outwards, while the lower is directed inwards and upwards.

TREATMENT.

In order to distinguish the crepitus, the upper part of the fore-arm should be grasped by the hand ; the thumb pressing at the upper and outer part below the joint, and pushing inwards the head of the radius, while the fingers at the same time draw the lower portion outwards : the arm being now rotated, the crepitus is discovered.

The treatment in this fracture consists in flexing the fore-arm, and placing it in a state between pronation and supination, in which situation the lower portion of the bone is held in a state of perfect rest ; for in this position the biceps, supinator brevis, and pronator teres are thrown into a state of relaxation, together with the mass of flexor and extensor muscles. A roller should be applied from the hand to the elbow ; previously to which a soft compress should be placed external to the head of the radius, and the bandage passed firmly around, securing it in its situation ; by means of which the head of the bone is forced inwards and retained in its natural situation. A broad splint applied both to the palmar and dorsal surfaces of the fore-arm retain the bones in their natural situations.

FIG. II.

FRACTURE OF THE RADIUS NEAR THE CENTRE.

- | | | | |
|-------|--------------------------------|----|---------------------|
| A. | Humerus. | E. | Supinator longus. |
| B. | Ulna. | F. | Pronator teres. |
| C. C. | Broken surfaces of the Radius. | G. | Pronator quadratus. |
| D. | Biceps muscle. | | |

APPEARANCES AND CAUSES OF FRACTURE.

Fractures of the radius are of more frequent occurrence than those of the ulna, from its immediate and extensive connexion with the bones of the wrist. The accident usually takes place from a fall forwards, the arms being thrown in the same direction instinctively ; in which situation the whole weight of the body is sustained by this bone. It may likewise take place from direct violence applied to the part. The former of these two causes is the more common. The radius forms an arch, the concavity of which looks towards the ulna, the convexity outwards : this form allows the free motion of the radius upon the ulna, increases the strength of the bone, and renders it less liable to fracture from violence applied externally : but when the force is applied at the extremity, the arched form, as constituting strength, is in this direction unavailing, and rather diminishes its strength ; so that upon the application of unnatural violence transmitted by the hand, the bone yields in the centre, and the broken surfaces are spurned outwards. The appearances in this fracture are, a fulness of the upper half of the fore-arm, with evident diminution of the lower half ; the motions of the arm are entirely lost ; the lower half is in a state of pronation beyond what is natural ; the hand hangs awkwardly with the thumb downwards.

CAUSES OF DISPLACEMENT.

The upper portion of the bone will be found drawn upwards and inwards, producing the fulness described at the upper part of the fore-arm : this arises from the actions of the biceps and pronator teres. The biceps, which is inserted into the tubercle of the radius, draws the superior portion of the bone up-

wards, at the same time that it rolls it outwards, giving it the supine position; while the pronator teres, which is inserted into the lower end of the upper portion, draws it inwards, and partly counteracts the actions of the biceps and supinator brevis (the situation of which muscle is shown in the last plate); so that this portion of the bone is held between pronation and supination, inclining to the supine state. The lower portion will be found drawn downwards and inwards to a state of complete pronation, the broken surface inclining towards the ulna, and nearly in contact with it, moving on a fixed point,—its attachment to the lower extremity of the ulna. This displacement is caused by the action of the pronator quadratus, which arises from the anterior surface of the ulna, and is inserted into the radius, as seen in the plate. This portion of the bone is likewise drawn into a state of pronation by the same muscle. It will likewise be remembered, that the supinator radii longus, instead of performing its natural action, in consequence of the lower extremity of the bone having now lost its centre of motion above, assists in depressing the broken surface; for by the action of this muscle, the styloid process into which it is inserted is elevated, being the lever to which the muscle is inserted: the ulna then becomes the fulcrum upon which the bone moves, so that the upper extremity of the lower portion is by means of the supinator radii longus and pronator quadratus held in contact with the ulna.

TREATMENT.

The treatment in this fracture consists in bringing the arm into the position between pronation and supination: the hand should be depressed, or allowed to hang unsupported: by now grasping the upper part of the fore-arm, the thumb pressing upon the superior part of the radius, and rotation produced, the crepitus becomes distinct. The fore-arm should be bound with a cotton roller from the hand to the elbow: the common lath splints should now be applied to each side of the arm, omitting only the inferior surface; for the ulna itself is the splint retaining the parts in their natural situation below. The radius, in this situation of the arm, is at the superior part (the fore-arm being flexed upon the arm); the splint situated above should not extend beyond the lower end of the radius. Those situated upon the palmar and dorsal surfaces should project beyond the wrist, in order that the hand may be prevented falling into an extreme state of pronation from its own weight, and from the action of the pronator quadratus. The hand being now allowed to fall by its own weight, is the principal feature in the management of this fracture. It will be seen that the broken end of the lower portion of the radius is drawn towards the ulna (depressed); the hand then being allowed to fall loose, will by its weight draw down the styloid process of the radius with it, moving on the ulna; consequently the depression of the lower end of the radius in this way will produce an elevation at the other extremity in accordance with its distance from the centre of motion: the lower portion is then brought upon the same level with the upper, and the parts adjusted in their natural relations.

Plate II.

Fig. 1.

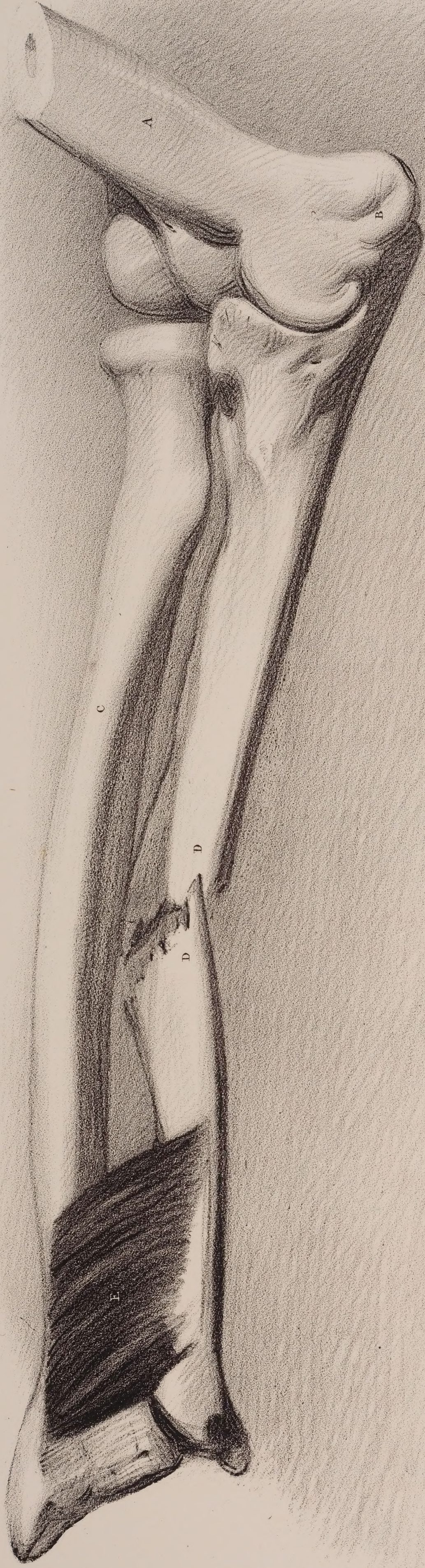


Fig. 2.

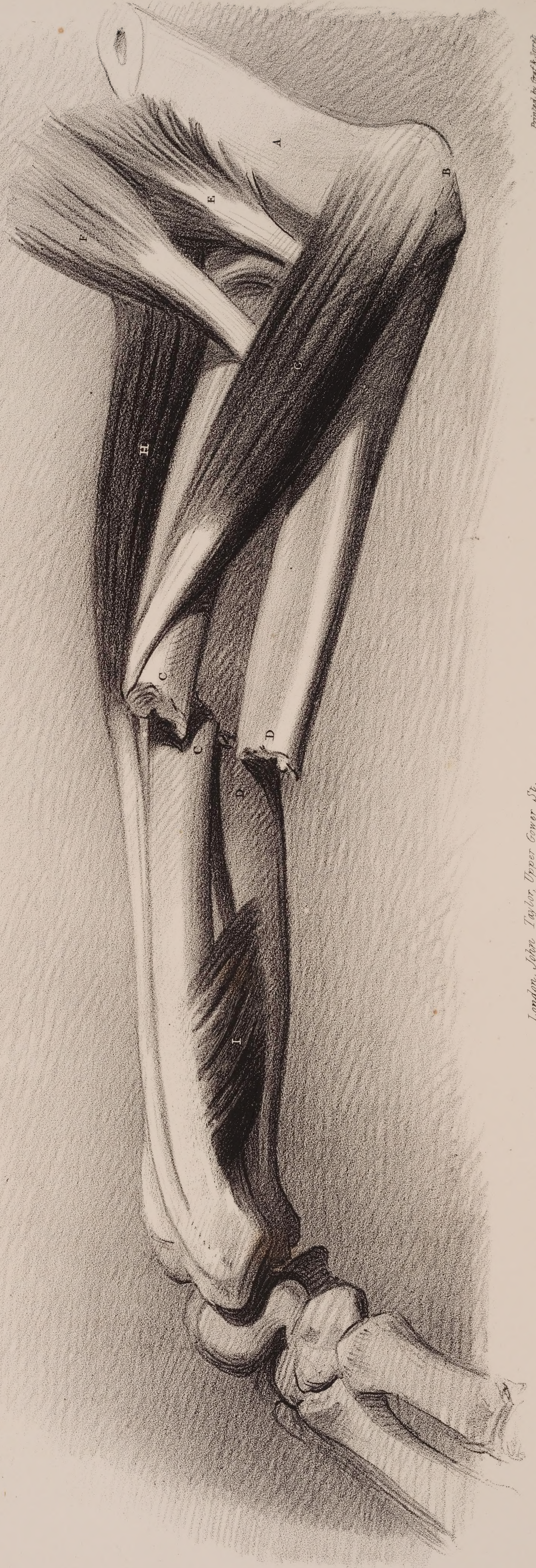


PLATE XI.

FIG. I.

FRACTURE OF THE SHAFT OF THE ULNA.

- | | |
|----------------------------------|------------------------------------|
| A. Humerus. | D. D. Broken surfaces of the Ulna. |
| B. Inner Condyle of the Humerus. | E. Pronator quadratus muscle. |
| C. Radius. | |

CAUSES OF FRACTURE.

The ulna is not so commonly the subject of fracture as the radius, the reasons are at once obvious: it is situated at the inner side of the arm, consequently protected by the radius, which is on the outer side. Its connexion with the carpus is much less extensive than that of the radius; and between its inferior surface and the os cuneiforme there is situated a yielding fibro-cartilage, by which the concussion communicated to the bone from the hand, when force is applied, is rendered less violent. The accident is usually caused by a blow applied directly upon the part.

The most common situation of fracture is a little below the centre, for at this point it is less protected by the soft parts; neither is the bone so strong, in this situation, for the spine, to which the interosseous ligament is attached, terminates here, so that this may be fairly denominated the weakest part of the bone.

APPEARANCES.

When the ulna is traced with the fingers, an evident depression can be felt at the inner and inferior part, in consequence of the lower portion of the ulna being directed outwards against the radius. The arm will likewise present an appearance of tumefaction, not only at the immediate situation of the fracture, but also upon the dorsal and palmar surfaces, by the partial protrusion of the muscles lying upon the interosseous ligament. The position of the limb will not be considerably changed; the motions are imperfectly performed, but still some degree of lateral movement may be accomplished by the patient without assistance, although attended with much pain.

CAUSES OF DISPLACEMENT.

The positions of the two portions of the bone will be seen accurately represented in the accompanying plan. The upper portion of the bone is retained in its natural situation by the brachialis anticus muscle. The carpal or lower extremity will be displaced by the action of the pronator quadratus, which draws the broken surface outwards in contact with the radius.

The radius itself has, in consequence of the fracture of the ulna, lost its principal means of support, which is the ulna itself; so that the weight of the hand depresses the radius, bringing it in contact with the broken surface of the upper portion of the ulna, which retains its natural situation. The radius is not thrown into a state of pronation; for the muscles performing the actions of pronation and supination are on the stretch when the arm is depressed, and by their combined actions retain the bone nearly in the natural situation. The supinators overcome the action of the pronators, for the pronator quadratus has now no control over the radius; its fixed point of origin, which is the ulna, being set at liberty, the muscle loses all control over the radius: the action of the supinators is still retained perfect, so that, were it not for the weight of the hand, the fore-arm would be thrown into the utmost state of supination.

TREATMENT.

By grasping the fleshy part of the arm with the left hand, and bringing the radius to the upper part, while with the right hand extension is produced at the wrist, at the same time that it is rotated, the crepitus will be distinctly felt.

Extension having been made, the muscles replaced, and the fractured surfaces brought into apposition, the fore-arm should be flexed, and held in the situation between pronation and supination. In the fracture of the bones of the fore-arm considerable care is requisite, from the disposition of the bones to fall to the interosseous space, where it is no unusual occurrence to find that the radius becomes united with the ulna (anchylosed), by which the rotative motions of the fore-arm would be entirely lost. The essential point in the treatment of this fracture consists in preserving the interosseous space undiminished: this is accomplished by placing two pads of soft material, one on the palmar and another on the dorsal surface of the fore-arm: firm splints should now be applied over these compresses, by which means they force the muscles which have been displaced into their natural situation between the bones, and prevent their approximation. Bandages are not usually recommended in these fractures; but simply an occasional strip, one at the elbow, another at the wrist, and a third in the centre of the fore-arm, which are amply sufficient to hold the splints in their places. The whole should now be supported in a leather sling, the hand kept in a line with the fore-arm, the thumb upwards.

FIG. II.

FRACTURE OF THE RADIUS AND ULNA NEAR THE CENTRE.

- | | |
|--------------------------------------|------------------------|
| A. Os humeri. | F. Biceps muscle. |
| B. Inner Condyle of the Humerus. | G. Pronator teres. |
| C. C. Broken surfaces of the Radius. | H. Supinator longus. |
| D. D. Broken surfaces of the Ulna. | I. Pronator quadratus. |
| E. Brachialis internus. | |

CAUSES OF FRACTURE.

This accident is generally the result of a heavy weight passing over the fore-arm; it may also occur from violence applied directly upon the part. The bones are occasionally broken just above the wrist: this accident is of rare occurrence, and takes place usually in young persons. (See the following plate.)

APPEARANCES.

When both bones are broken from the causes enumerated above, the tumefaction will be considerable from the bruising of the soft part; but should the case be examined immediately after the injury, the appearances will generally be found as described by all authors: there is little shortening of the limb, but an angular bend may be readily seen, by the bones projecting and pushing out the soft part on the dorsum; the wrist is drawn forwards; a degree of swelling is seen, not only on the dorsum, but also on the palmar surface of the fore-arm, in consequence of the displacement of the muscles lying upon the interosseous ligament; the hand is depressed and proned; the power of pronation and supination is entirely lost. The crepitus is distinct upon making extension, and at the same time rotating the arm at the wrist.

CAUSES OF DISPLACEMENT.

The displacement of the bones depends upon the following causes:

It is not always the case that the lower portions are drawn backwards, as represented in the plate;

although it is the most usual situation for them after such accident: they are occasionally drawn forwards; this, however, depends altogether upon the nature and manner of the force or weight applied.

The portion of the radius above the fracture will be found inclining upwards and inwards, and lying above the level of the ulna: this position depends upon the action of the biceps and pronator teres; the former raising the broken surface, while the latter gives it the direction inwards. This portion of the radius will likewise be rolled upon itself by the biceps acting as a supinator together with the supinator brevis.

The upper portion of the ulna retains nearly its natural situation, but a little elevated by the brachialis anticus: the space between the bones above the fracture is always maintained to its full extent.

The principal displacement occurs below the fracture: the lower portions of the radius and ulna are drawn in contact by the pronator quadratus muscle; the radius rolling to the inner side of the ulna in a state of pronation; by the action of this muscle added to the weight of the hand.

The broken surfaces are then in contact, and drawn upwards by the combined actions of the flexor and extensor muscles.

TREATMENT.

The treatment adopted in this case is the same as in the fracture of the ulna. (See description of fig. i. plate xi.)

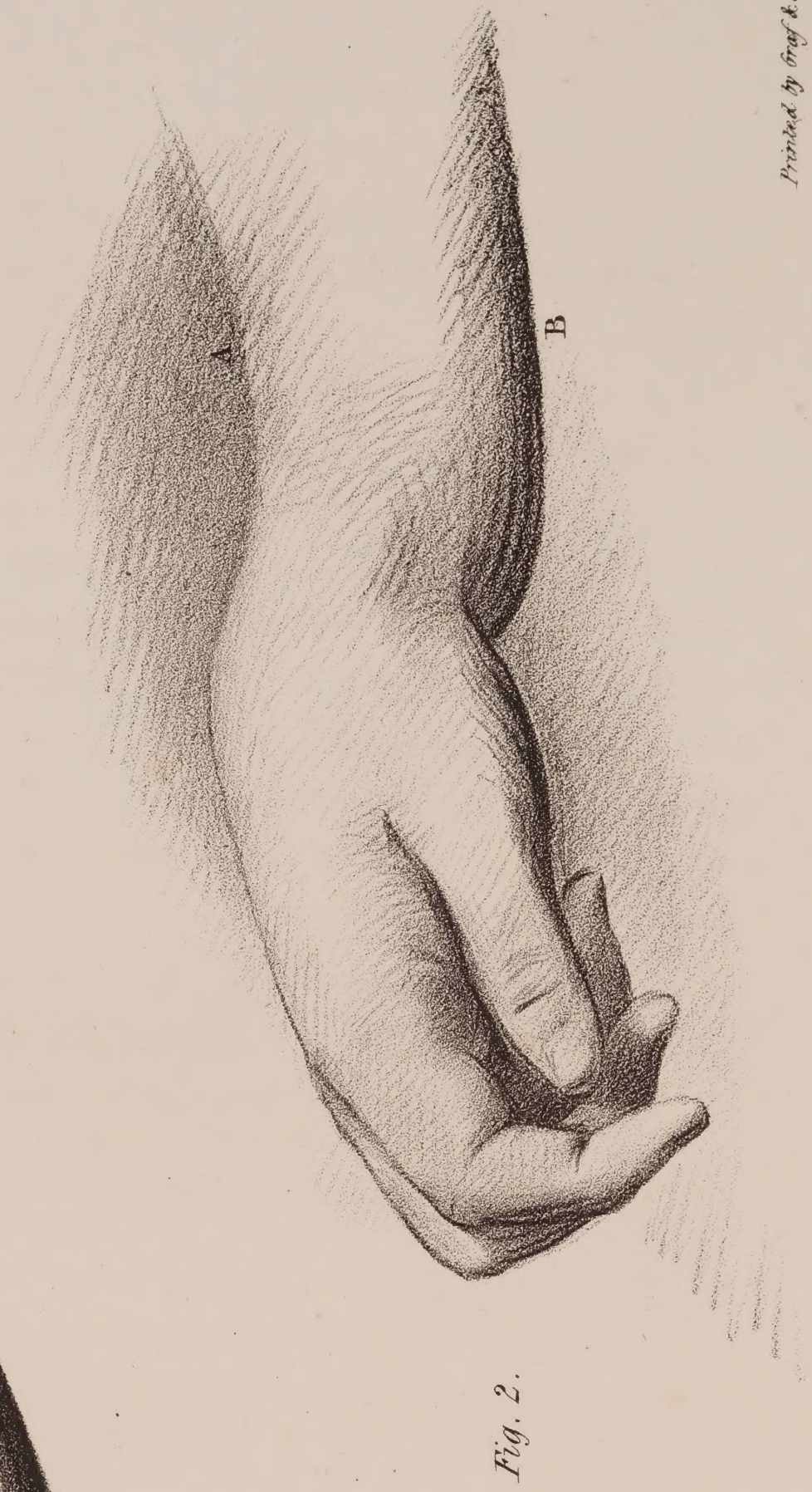
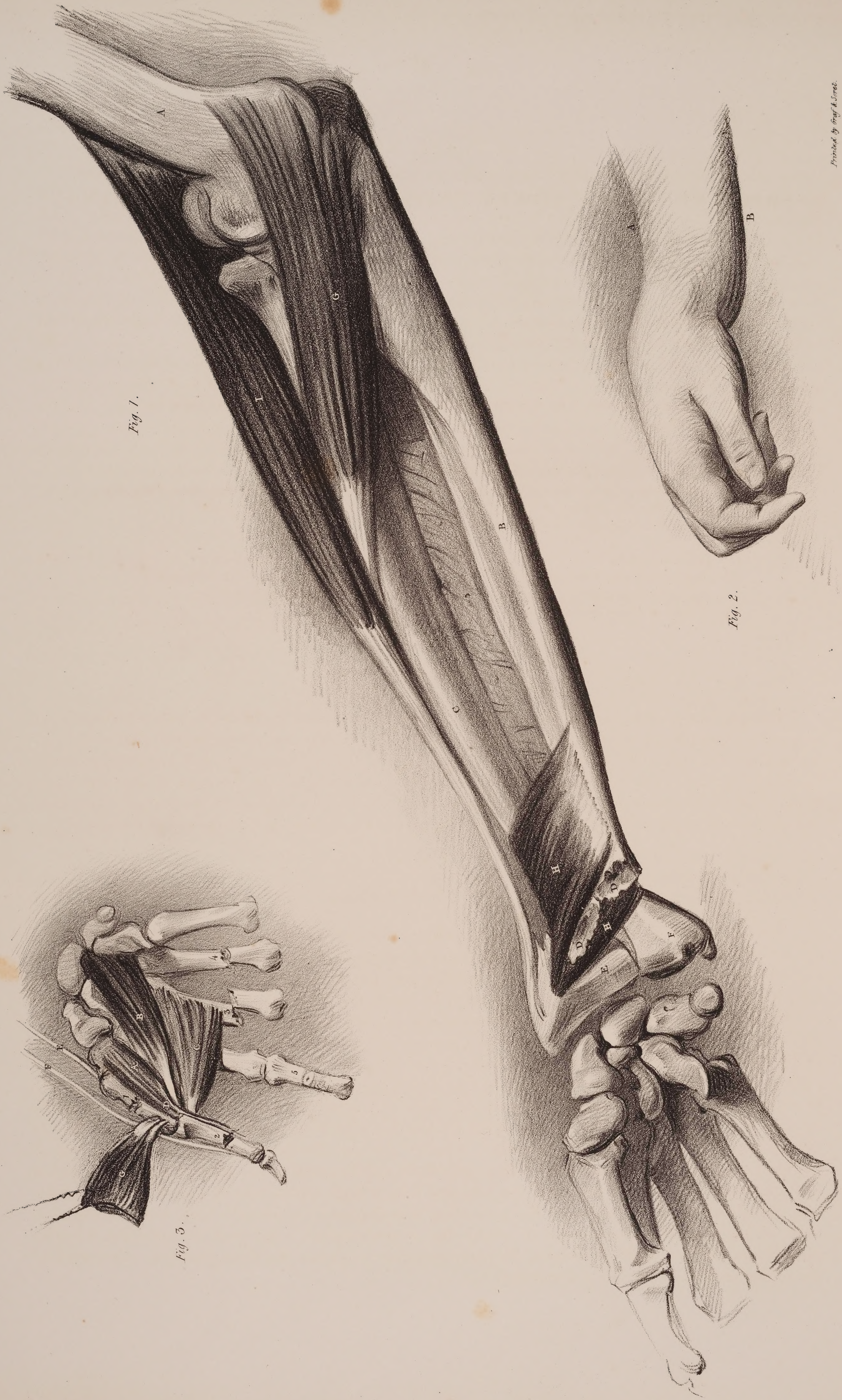
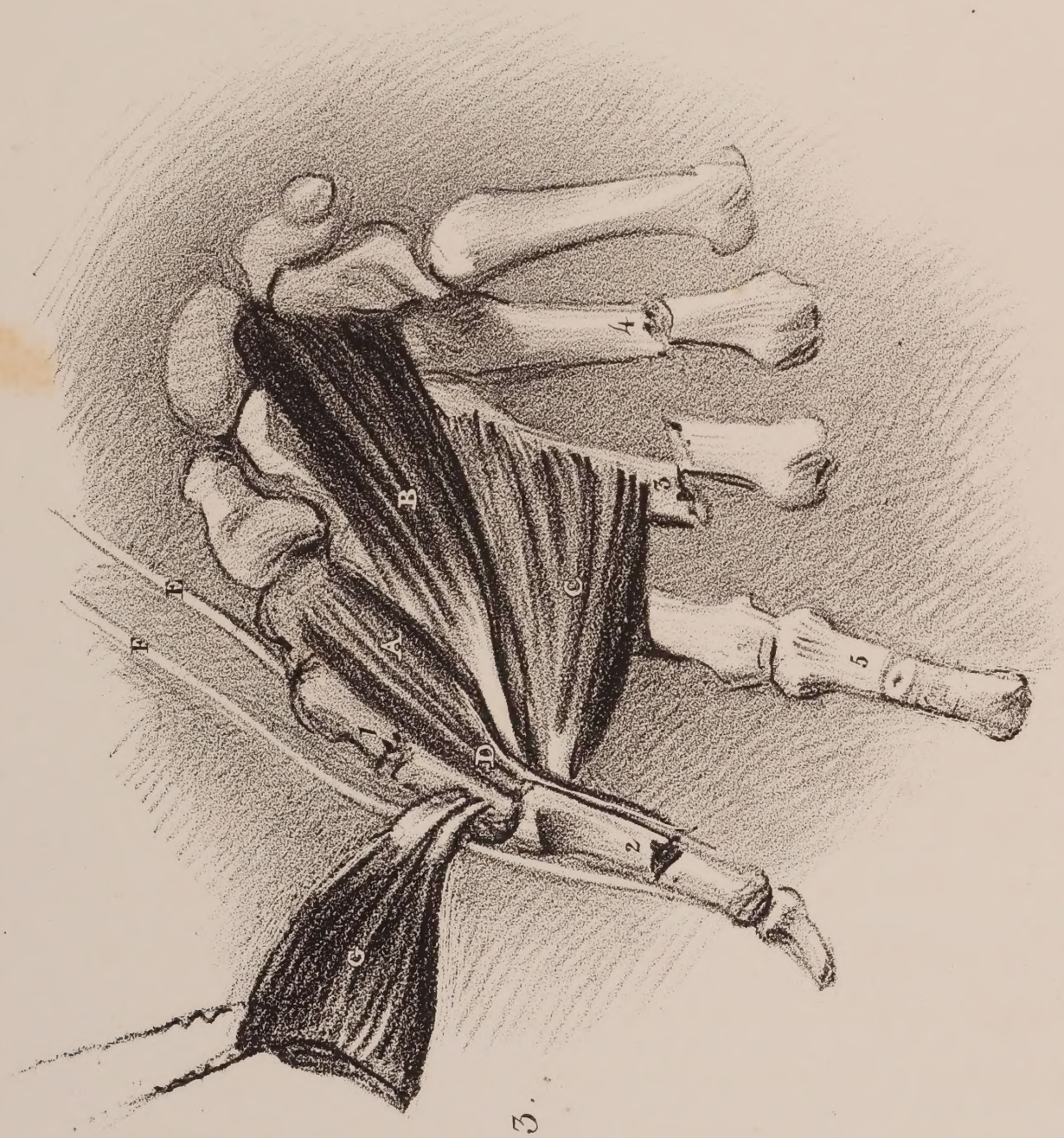


PLATE XII.

FRACTURE OF THE LOWER ENDS OF THE RADIUS AND ULNA.

FIG. I.

- | | |
|---|---------------------------------------|
| A. Humerus. | E. Lower end of the Radius displaced. |
| B. Ulna. | F. Lower end of the Ulna displaced. |
| C. Radius. | G. Pronator teres. |
| D. D. Broken surfaces of the upper portions of the Radius and Ulna. | H. H. Pronator quadratus. |
| | I. Supinator longus. |

FIG. II.

Snows the appearance of the wrist after fracture has taken place, and its resemblance to dislocation.

- | | |
|--------------------|--------------------|
| A. Dorsal surface. | B. Palmar surface. |
|--------------------|--------------------|

FIG. III. — FRACTURES OF THE FINGERS.

- | | |
|--|--|
| 1. Fracture of the metacarpal bone of the thumb. | 4. Fracture of the metacarpal bone of ring finger. |
| 2. Fracture of the first phalanx of the thumb. | 5. Fracture of the first phalanx. |
| 3. Fracture of the metacarpal bone of the middle finger. | |
| A. Opponens pollicis. | E. Abductor longus pollicis. |
| B. Part of the Flexor brevis pollicis. | F. Extensor secundi internodii pollicis |
| C. Adductor brevis pollicis. | G. Abductor brevis pollicis. |
| D. Tendon of Flexor longus pollicis. | |

CAUSES OF FRACTURE.

This accident is more frequent in children, is of rare occurrence in the adult, and is perhaps more properly a separation of the apophyses from the epiphyses. It does not always happen that both bones are broken: the radius may be said always to suffer; the ulna is more frequently only bent, and generally escapes altogether. The injury usually arises by a fall from a height. In two cases of late occurrence, from which the accompanying drawings were made, the fracture was occasioned by the patient falling from the window-sill while in the act of cleaning the window; and both were girls of the age of sixteen.

APPEARANCES.

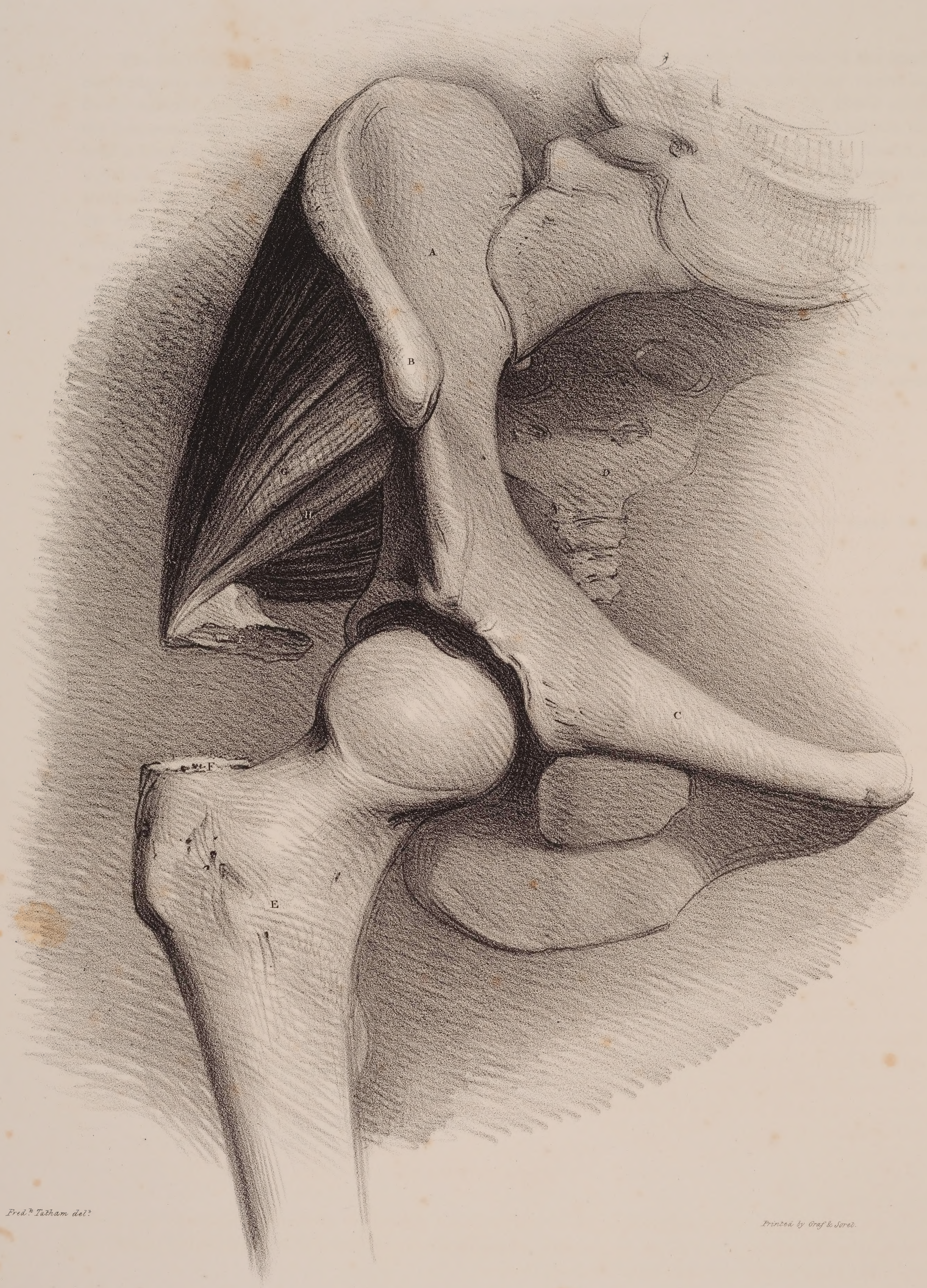
The appearances in this fracture very much resemble dislocation of the carpus backwards: great pain is felt at the seat of injury, and considerable bruising, and ecchymosis is the consequence, accompanied always with projection as well as tumefaction on the anterior part just above the carpus; for it generally happens that this point comes in contact with the ground, by which means the detached lower ends of the bones are driven backwards, while the broken surfaces of the upper portions of the bones are forced forwards, producing the prominence on the anterior part, in consequence of the integument being drawn tightly round them, and so rendering the displacement more evident. Fig. ii. of the accompanying plate will explain this; for the detached portions will be seen drawn upwards behind the ends of the upper portion, by which means a prominence takes place on the back part below the level of that which exists on the anterior part; so that when the swelling exists on the one side, a corresponding depression necessarily takes place at the point immediately opposite. Another great peculiarity in this accident is the position of the hand compared with that of the fore-arm: the hand will be found in the position between pronation and supination, at the same time that the fore-arm is in a state approaching to a more complete pronation, though not to the full extent. The parts being thus displaced, considerable force will be required in order to produce sufficient extension to render the crepitus distinct; and when the extension is accomplished, and the force again withdrawn, the parts immediately resume the same situation: the control of the rolling motions of the arm is completely lost.

CAUSES OF DISPLACEMENT.

The fracture having taken place from the force applied, not perpendicularly to the ends of the bones, but obliquely against their lower extremities, they give way near the extremities, which are as yet not firmly united: immediately upon the separation, the force gives them the direction of the dorsal side of the fore-arm, where they are instantly drawn up by the combined actions of the flexors and extensors, and held behind the lower ends of the upper portions. (In a dissection not long since made by Mr. Arnott, in a girl who died with peritonitis, consequent upon the injuries received during a fall which produced this accident, the situation of the parts was precisely that which is represented in fig. i.) Independently of the drawing backwards of these portions, their broken surfaces are held together by a few remaining fibres of the pronator quadratus; and in the case just alluded to, the broken surface of the upper portion of the radius projected through the fibres of that muscle. The situation of these portions, likewise, will at once explain why the hand takes a direction differing from that of the fore-arm. The broken surfaces of the shafts of the two bones will be found drawn almost in close relation by the action of the pronator quadratus, and thrown into a state of pronation by the pronator teres, the broken surfaces projecting forwards; so that the detached portions are held in close relation behind the upper portions; the styloid process of the radius being elevated by the supinator longus, and the wrist supported by the extensor carpi radialis longior and brevior, and extensors of the thumb.

TREATMENT.

The treatment recommended in this case is the same as described in the fracture of these bones higher up. (See description of plate xi. fig. ii.)



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PLATE XIII.

FRACTURE OF THE GREAT TROCHANTER OF THE FEMUR.

- | | |
|---|---|
| A. Ilium. | E. Femur. |
| B. Anterior superior spinous process
of the Ilium. | F. F. Broken surfaces of the Trochanter
major. |
| C. Pecten of the Pubes. | G. Glutæus medius. |
| D. Sacrum. | H. Glutæus minimus. |

CAUSES OF FRACTURE.

This accident is of exceedingly rare occurrence, and may take place from a fall, when this point of the bone, meeting directly the resistance below, is broken off near the tip, or at the root. In the plan it is represented midway between these points.

APPEARANCES.

The appearances, when this accident has taken place, will scarcely lead to the suspicion of fracture : the patient refers you to the seat of pain ; but, from the indistinctness of these parts even in the natural condition, little can be gained by examination. The position of the limb remains unaltered ; there is neither eversion nor shortening. In a case related by Sir A. Cooper, the patient, who was a girl aged sixteen, walked to her home, and applied only for advice six days after the accident. Placing the patient in the erect position, and bringing the knees together, will afford the best means of distinguishing the nature of the injury, for in that position the trochanters are rendered most prominent : and upon comparing the two sides, and examining with the fingers applied to either, a depression may be detected between the loose and fixed portions ; but the force requisite in producing this fracture creates occasionally so much tumefaction, that we may be deprived even of this assistance. The portion of bone which is displaced is likewise so small that it is with difficulty distinguished. A slight prominence and increased rigidity may be observed above the trochanter, and by abducting the thigh, at the same time that the glutæi muscles are pressed downwards, an indistinct crepitus may be felt.

Where the fracture has occurred from excessive violence, the displacement would take place to a much greater extent than when a less degree of force is applied ; for in the former case the strong prolongation of the tendons would be lacerated.

CAUSES OF DISPLACEMENT.

The causes of displacement are the glutæus medius and minimus, by which the loose portion is drawn upwards and inclined forwards ; but should the fracture have taken place at the root, then the displacement of the detached portion would be carried to a greater extent ; for by the attachments of the external rotators, viz. the pyriformis, gemellus superior, obturator internus, gemellus inferior, and obturator externus, all of which are inserted into the pit of the trochanter, it would be drawn not only upwards, as shown in the plate, but inwards towards the dorsum of the ilium, thus increasing considerably the diagnosis of the injury.

TREATMENT.

The adjustment of the fractured surfaces will be found difficult to accomplish, and will not, perhaps, be fully produced for some days ; particularly where the fractured portion is considerably raised, which may take place to the extent of more than two inches.

The plan which has been adopted, and by which means the broken surfaces are brought into apposition, and the displacing muscles relaxed, is, after the patient has been laid in bed on a firm hair mattress, to abduct the extremity to nearly its fullest extent; in this way the broken surface below the point of fracture is elevated. A broad strap, padded upon the surface applied to the skin, should be fixed round the lower part of the loins, extending over the ilium of the injured side: to this a firm broad pad is attached: another strap should now be placed around the upper part of the thigh, with buckles, for the purpose of being connected with the pad of the strap around the loins. The muscles above, viz. the glutæus medius and minimus, should now be gradually extended, and the loose portion brought down, so that the broken surfaces are held in contact. A soft pad of lint should now be applied above the loose bone, where it should be fixed by connecting the straps of the leather bands around the thigh and loins. In this manner a constant pressure is applied over the parts generally, but more particularly above the loose portion of the trochanter: the disposition of the patient to adduct the limb is also prevented by the connexion of these straps.

The necessity of the patient to quit the horizontal position should be on every occasion obviated, as perfect rest is necessary for the union of these parts, so readily displaced either by the motion of the extremity or the trunk.



Fred. Tatham del.

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PLATE XIV.

FRACTURE OF THE NECK OF THE THIGH-BONE.

- | | | | |
|-------|--|-------|-----------------------------|
| A. | Anterior superior spinous process
of the Ilium. | I. I. | Glutæus maximus. |
| B. | Pubes. | J. J. | Pyriformis. |
| C. | Sacrum. | K. | Gemellus superior. |
| D. | Head of the Femur. | L. | Obturator internus. |
| E. | Shaft of the Femur. | M. | Gemellus inferior. |
| F. F. | Fractured surfaces of the Femur. | N. N. | Obturator externus. |
| G. | Glutæus medius. | O. O. | Quadratus femoris. |
| H. | Glutæus minimus. | P. | Iliacus internus reflected. |
| | | Q. | Psoas magnus reflected. |

CAUSES OF FRACTURE.

The causes of this fracture depend entirely upon circumstances connected with the age of the individual; and it has been known only in a few instances to have occurred prior to the age of fifty years. The neck of the femur in old age differs in its direction from that which it had in youth. In the natural state, the neck of the femur looks obliquely upwards and inwards, and, by means of the oblique position of the shaft of the bone, is placed nearly in a perpendicular direction under the trunk; so that the weight of the body falls upon the trochanters. Were the neck to extend transversely, fracture would be undoubtedly of common occurrence: the obliquity is a provision against injury during sudden or unexpected violence, as a fall from a height, or injury applied by the usual means. In old age the neck of the bone loses this obliquity, which had hitherto been the means of its preservation from fracture, and becomes nearly horizontal, and occasionally on a level, and even below a level, with the trochanter major: the cancellated texture of the bone loses its power of resistance: and the strong arrangement of this texture, which extends from the trochanter minor, no longer retains its original buttress-like support: the shell of the bone also becomes thin, and the natural deposit of animal matter less abundant; so that the brittleness of the bone, together with the circumstances already enumerated, render it liable to fracture by the application even of a slight degree of force. In a healthy man in the prime of life, an injury applied in such a manner as to produce fracture of the neck of the thigh-bone in the aged person, would in all probability produce dislocation of the head of the femur: for the firm and mechanically strengthened bone would, rather than give way, act as a lever, displacing the head; the ligaments yielding more readily than the bone. The accident takes place sometimes when the patient is descending a flight of stairs; the foot slipping, or the person making a false step; when the impetus, together with the weight of the body, falls directly upon the neck of the bone: it likewise frequently occurs from the foot slipping from the curb-stone to the street, when the force is applied in a similar manner and with the same effect as in the former case; for the weight then coming perpendicularly upon the head of the bone, which is less capable of sustaining the sudden application of force, from its new horizontal direction, and its weakened and brittle character, causes the bone to give way at its neck.

APPEARANCES.

This injury is characterised by shortening of the limb and eversion of the foot, which form the principal diagnostic marks of the accident: it cannot readily be mistaken for dislocation either upon the pubes or into the thyroid foramen; for in neither of these cases is there any degree of shortening, although the foot takes the same direction, outwards. In the dislocations upwards, the leg becomes shorter, but the toes are invariably directed inwards. The shortening of the limb may take place to the extent of two inches, or even more; but in some cases, though of rare occurrence, little deformity occurs, as when the fracture

takes place at the root of the trochanter ; the neck of the bone, splitting the trochanters, becomes wedged into the fissure, and may, as it occasionally does, limit the retraction and eversion of the extremity. The patient loses the control over the limb, which lies parallel with that of the uninjured side : deep-seated pain is also felt in the groin, in consequence of the pressure of the *psaos magnus* and *iliacus internus* over the capsular ligament and head of the bone : a degree of unnatural fulness takes place at the outer and upper part of the hip, from the swelling of the contracted muscles ; although the trochanter major becomes less distinct, not only in appearance, but to the touch. The retraction, and even the eversion of the limb, do not always immediately follow the injury. In such cases, however, by the immediate rotation of the limb, the crepitus would be instantly distinguished. Where the limb assumes the usual position, i. e. shortened and turned outwards, the crepitus cannot be felt, unless extension is made so far as to bring the limb to its original length. Much unnecessary pain may be avoided by abducting the upper part of the bone, at the same time that the limb is rotated and fully extended : this accomplished, the hand should be made to press firmly upon the trochanter, for now the broken surface of the shaft is brought down to the broken surface of that portion which remains fixed in the acetabulum ; and by rotating the limb, the crepitus is immediately felt. In producing rotation, the hand being placed upon the trochanter major, the arc it describes will be found somewhat less than when in its natural state, and as though it moved round its own axis instead of the natural and more remote centre, the head of the bone in the acetabulum.

Little difficulty can be experienced in this case as to determining between fracture and dislocation ; for in dislocation the head of the bone remains firmly fixed, while in fracture a certain degree of motion is permitted : neither does the bone yield so readily in dislocation to extension ; and when the dislodgement of the head of the bone commences, instead of gliding smoothly as in fracture, it descends by jerks, catching on the irregularities of the opposing surfaces.

CAUSES OF DISPLACEMENT.

The eversion of the limb takes place from the combined actions of the external rotators, viz. the *pyriformis*, *gemellus superior*, *obturator internus*, *gemellus inferior*, *obturator externus*, all of which are inserted into the trochanteric fossa, while the *quadratus femoris* is inserted into the intertrochanteric line ; these are situated on the posterior part : on the anterior part, the *psaos magnus* and *iliacus internus*, which run down to be inserted into the posterior surface of the lesser trochanter, also act powerfully in producing the eversion. These, aided by the action of the *glutæi*, together with the *pectinæus* and *triceps adductor* muscles, which are inserted into the inner edge of the *linea aspera*, assist in producing this change in the position. Independently of the actions attributed to some of those muscles already enumerated as rolling the bone outwards, they likewise combine in drawing upwards the shaft of the bone ; but independently of these, the *rectus femoris* will be found the principal agent in this action on the anterior part, while the *biceps*, *semimembranosus*, and *semitendinosus* act on the posterior part. Those already enumerated as external rotators, which assist in the retraction of the limb, are the *glutæus medius* and *minimus*, *psaos magnus*, *iliacus internus*, and the four adductors. It is a matter not altogether agreed upon, whether these muscles are actually the cause of the eversion : it is stated that it arises from the natural inclination of the limb and weight of the foot. The whole weight of the thigh is certainly external to the centre or axis upon which it moves, which would favour this opinion ; but this eversion is surely under the control of the immense mass of muscles retracting the limb, which would hold it in its natural position ; and were it not for the external rotators, the leg would remain with the toes pointing obliquely rather than directly outwards.

TREATMENT.

In the treatment of this fracture many plans have been suggested ; some surgeons preferring the straight position of the limb, and extension produced by the application of Dessault's splint : but the means now most usually adopted are both simple in their application, and decidedly the most agreeable and comfortable to the patient ; this is of course a circumstance not altogether to be neglected, as the patient will have to lie in the same position for some length of time : it consists simply in placing the limb upon the double inclined plane, the surface of which is covered with soft cushions. The

patient being placed in bed in a sitting posture, the limb is extended, and the thigh and leg placed upon the inclined plane; in this way the whole of the displacing muscles are at once either relaxed or counteracted. The retracting muscles, as already enumerated, are, by flexing the thigh upon the trunk, and again flexing the leg upon the thigh, immediately relaxed by bringing their points of origin nearer to those of their insertion. The rotating muscles are controlled by applying pads or small cushions to the outer part of the limb, which may be secured round the extremity, including the plane; or by fixing the foot with a cotton roller to any point below its own level: indeed, by these means, the limb is prevented being retracted, should the patient slide down into the bed: or should greater extension be required, by placing pads below the bend of the knee, the obliquity, and consequent extension, may be increased at will.

N.B. The upper part of the shaft of the femur is here necessarily drawn outwards somewhat beyond the situation it would naturally occupy, for the purpose of showing more fully the muscles at the posterior part, which would be otherwise entirely concealed.

Fig. 1.



Fig. 2.



PLATE XV.

FRACTURE OF THE FEMUR BELOW THE TROCHANTER MINOR.

FIG. I.

- | | | | |
|-------|-------------------------------|----|-------------------|
| A. | Pubes. | G. | Iliacus internus. |
| B. | Upper portion of the Femur. | H. | Psoas magnus. |
| C. | Shaft of the Femur. | I. | Pectinæus. |
| D. D. | Broken surfaces of the Femur. | J. | Adductor longus. |
| E. | Glutæus medius. | K. | Adductor magnus. |
| F. | Glutæus minimus. | | |

FIG. II.

Exhibits the muscles retracting the lower portion of the Femur.

- | | | | |
|----|-----------------|-------|-------------------------------------|
| A. | Rectus femoris. | C. D. | Semimembranosus and semitendinosus. |
| B. | Biceps. | | |

CAUSES OF FRACTURE.

This fracture may take place by the application of force immediately to the part, or by the limb being bent obliquely under the trunk during a fall, or from force applied in a line perpendicular with the bone. Fracture at this point is not so common in its occurrence as that at the middle of the shaft or at the lower end of the femur.

APPEARANCES.

The most prominent feature in the character of the limb subsequent to this accident, is an unnatural protrusion at the upper part of the thigh, in consequence of the drawing forwards of the upper portion: more than usual pain takes place in this situation of fracture, from the greater degree of displacement that occurs; the broken and ragged surface being drawn directly forwards, when more or less of the soft parts suffer injury and laceration. The limb will become slightly everted, and at the same time shortened.

The displacement will be found principally to have taken place in the upper portion of the bone, the lower having suffered slight eversion, but retracted to a considerable extent: the crepitus cannot be discovered under the ordinary means of extension and rotation, for the two surfaces look in nearly opposite directions; that of the superior portion will be directed upwards and forwards, while the lower will look backwards and incline downwards. Should the attempt to reduce the fracture be made by depressing the upper portion, and extending the lower till the surfaces meet, much unnecessary pain will be the consequence; for, upon the removal of the pressure, the bone would be again immediately drawn upwards to the same situation it before occupied, when fresh laceration of the soft parts would be the result. For this purpose, the thigh should be raised until the lower portion is brought upon the same line with the upper, when the deformity would disappear, and the crepitus be at once discovered.

CAUSES OF DISPLACEMENT.

The displacement is greater in the upper than in the lower portion: it will be found projecting almost at a right angle with the pelvis, producing the elevation already described, in consequence of the actions of the psoas magnus and iliacus internus, both of which are inserted by means of a combined tendon into the posterior surface of the lesser trochanter; independently of the elevation, it will be found also rolled outwards upon its own axis, by the actions of the two last-named muscles, together with the external rotators, viz. pyriformis, gemellus superior, obturator internus, gemellus inferior, obturator externus, and quadratus femoris, as seen inserted into the pit of the trochanter, in the foregoing plate, at the same time that its natural obliquity will be somewhat destroyed by the actions of the glutæi

muscles. The displacement of this portion is considerably greater than in the fracture at the middle of the shaft, for in that case a greater surface of resistance is offered by the opposing soft parts above it, independently of the longer lever power of the bone, which would in some degree oppose the action of the displacing muscles.

The displacement of the lower portion is governed principally by the actions of the pectinæus and the three adductor muscles; all of which being inserted into the inner edge of the *linea aspera*, draw it upwards and inwards, at the same time that it is slightly everted by the same muscles, directing the toe outwards. The retraction of the limb is produced by the actions of the rectus on the fore part, and by the biceps, semimembranosus, and semitendinosus on the posterior part; so that the broken surface of this extremity of the bone is pulled upwards, behind and to the inner side of the upper portion.

TREATMENT.

The plan of treatment in all fractures of the thigh, whether situated high up, as in the accompanying plan, or in the situation of the two succeeding ones, is generally the same. The means adopted, however, are of two kinds; each having strenuous supporters, and each pretending to possess a decided superiority over the other. The one consists in placing the limb upon the double inclined plane, by which the displacing muscles are all brought more or less into a state of repose; the other, in extending the limb by means of the long splint, without any attention to the great principle in the treatment of fracture,—the relaxation of the displacing muscles. In the former, the plan of proceeding, as soon as circumstances will admit, is to produce extension at the knee, at the same time that the lower portion is raised on a line with the upper, when the broken surfaces are brought in contact; for the upper portion is drawn up, and there held so firmly, that some little difficulty will be experienced in depressing it, and when brought down to its proper level, its tendency to the original displacement will be a means of great annoyance and difficulty during the after treatment; so that by raising the lower portion, and bringing it to the same level with the upper, the difficulties are in a great measure obviated. In this position the thigh should be surrounded with a cotton roller neatly applied from the knee to the hip; and a broad splint, lined with lint, or tow, should be placed along the outer part, while another also should be applied to the inner side: both being secured firmly by means of a broad cotton roller; the limb being now laid upon the inclined plane, and the patient placed nearly in a sitting posture. In this position the femur will be flexed upon the pelvis, and the points of attachment of the *psoas magnus* and *iliacus internus* approximated, and consequently their power and extent of contraction diminished. Independently of the advantage already arising from this position of the limb, the retracting muscles will likewise be considerably relaxed; for the knee being elevated and the pelvis advanced, the attachments of the rectus are brought nearer each other, so that its action is in a great measure lessened. We have yet remaining the retractor muscles on the posterior part of the thigh: the position of the leg on the inclined plane also answers the end of relaxing these, which are the biceps, semimembranosus, and semitendinosus; for, by flexing the leg, their insertions into the bones of the leg are made to approach their origins from the tuberosity of the ischium.

The application of the long splint is alike simple as the foregoing. The limb having been extended, and the apposition of the bones procured, the surgeon commences by rolling the extremity from the foot to the hip, enveloping it thickly in its whole extent with successive layers of cotton bandages: the limb during this process is kept in the extended position. Dessault's long splint is now applied to the outer surface, having been previously well lined with soft tow or cotton, so that the adaptation to the irregularities of the surface may be more perfect, and likewise prevent unequal pressure: having adjusted it to the outer side of the limb, it is now secured firmly (extension being again applied) by repeated layers of bandage, so that the limb is fairly cased and immoveable. A soft pad is now to be placed between the scrotum and upper part of the thigh of the injured side; a broad strong tape is placed below the pad, the ends of which are brought outwards, one anterior to the thigh, the other behind it: the two ends of the tape are now brought through separate divisions in the upper part of the splint, and, when pulled upon in a direction downwards, act as a lever, forcing the splint downwards, and with it the limb to which it is attached: in this way extension is made until the limbs are of equal length, when they are secured by a knot, so that the extension may be either diminished or increased at will.

Fig. 1.



Fig. 2.

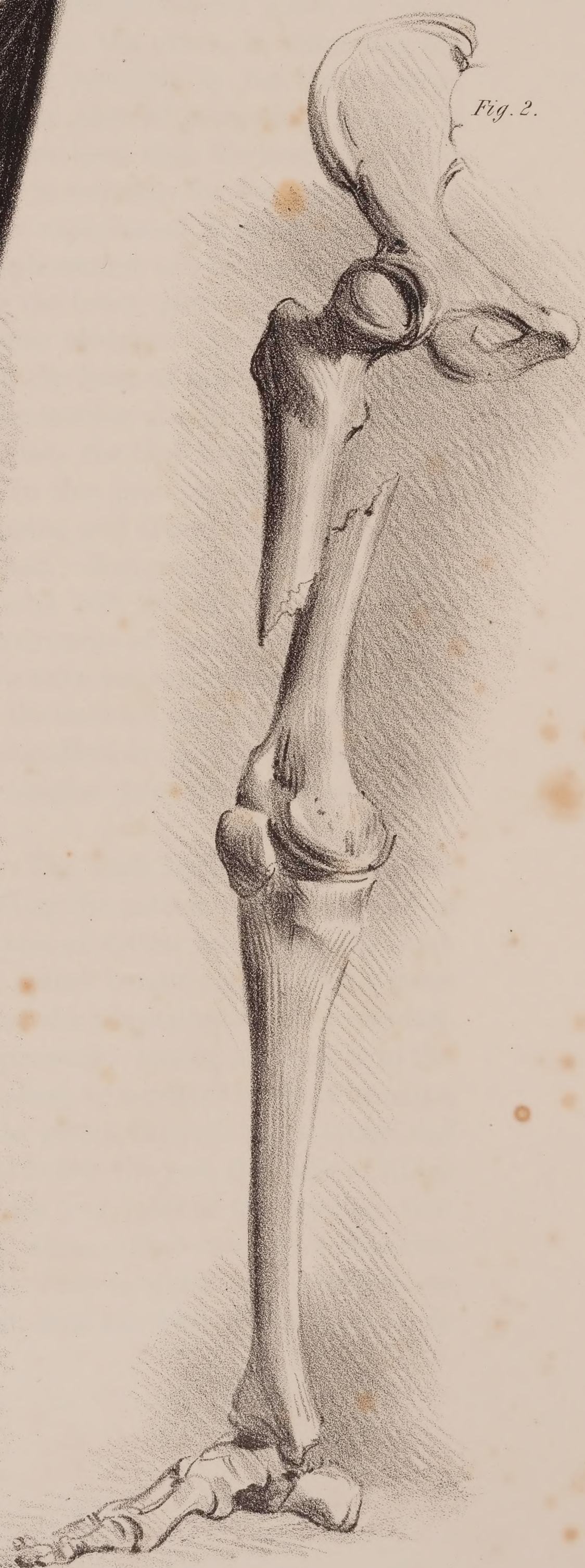


PLATE XVI.

FRACTURE OF THE SHAFT OF THE FEMUR NEAR THE CENTRE.

FIG. I.

- | | |
|-------------------------------------|----------------------------|
| A. A. Femur. | F. Adductor longus. |
| B. B. Broken surfaces of the Femur. | G. Adductor magnus. |
| C. Psoas magnus. | H. Glutæus medius. |
| D. Iliacus internus. | I. Symphysis of the Pubis. |
| E. Pectinæus. | |

FIG. II.

Shows the position of the leg and foot.

The circumstances connected with this fracture, both with regard to its causes, displacement, and likewise the treatment, are fully detailed in the description of the preceding plate. The appearance of the limb differs so far from the foregoing, that the prominence produced by the elevation of the broken surface of the upper portion is much less distinct than in the fracture higher up. The eversion is likewise more complete; for in this situation the glutæus maximus has no control over the lower portion; so that it is not only everted to a greater extent, but the broken surface takes a more oblique direction inwards. Fig. ii. of the succeeding plate will likewise show why the broken surface of this portion is also inclined backwards, which takes place from the attachments of the gastrocnemius, popliteus, and plantaris muscles.

Fig. 1.



Fig. 2.



Fig. 3.



PLATE XVII.

FRACTURE OF THE FEMUR IMMEDIATELY ABOVE THE CONDYLES.

FIG. I.

- | | | | |
|-------|-------------------------------|-------|-------------------------------------|
| A. A. | Broken surfaces of the Femur. | F. | Part of the vastus externus. |
| B. | The Tibia. | G. G. | The two heads of the Biceps muscle. |
| C. | Fibula. | H. | Semitendinosus. |
| D. | Patella. | I. | Semimembranosus. |
| E. | Rectus femoris. | J. | Gastrocnemius. |

FIG. II.

Shows the upper attachment of the Plantaris.

FIG. III.

Shows the upper attachments of the Gastrocnemius.

CAUSES OF FRACTURE.

Fracture in this situation, as in all fractures of the femur, arises either from a fall, or from violence applied directly to the part ; but should the weight or force be applied obliquely to, and not in a line with, the shaft of the bone, the fracture would take place in the same direction obliquely.

APPEARANCES.

The appearances consequent upon this accident vary to a certain extent from those which have been described as presenting themselves in the foregoing fractures of the same bone. The limb will be found somewhat shorter than natural, dependent upon the same causes as the preceding. The foot, likewise, will be everted. The patient will lose the power of motion in the leg; and great pain will be felt at the immediate seat of the injury, and not unfrequently accompanied with numbness and cramp of the under surface of the foot and toes. Upon examination, the circumference of the thigh just above the knee will be found somewhat increased; and by pressing the finger deep into the popliteal space, the displaced portion of the bone can be felt projecting backwards.

CAUSES OF DISPLACEMENT.

The lower portion of the bone will be found principally displaced, and will be observed drawn backwards, by a set of muscles which produced little or no effect in the fractures which have been shown in other situations of this bone; these muscles are the gastrocnemius, plantaris, and popliteus: the first of which arises as seen in fig. iii, and is attached to the os calcis; so that the fibres of the muscle contracting, the broken surface of the lower portion is directed backwards, the upper heads or origins of this muscle having now become the moveable attachments: the remaining two muscles likewise assist in the same action, and with the same effect. The upper portion of the bone will be found little changed in its direction; with this exception, that it inclines to a state of adduction and partial elevation, being raised by the psoas magnus and iliacus internus, and drawn inwards by the pectinæus adductor brevis, longus, and magnus. The remaining circumstances connected with the displacement, viz. the eversion and retraction of the parts inferior to the fracture, are produced by the same muscles that have been already described in the explanation of plate xv, producing the same effect.

TREATMENT.

The plan for the adjustment of the broken surfaces in this fracture may be conducted upon the same principle as in the two preceding cases, the details of which will be found in the description of plate xv. Should the double inclined plane be preferred, the flexed position of the leg will at once relax the gastrocnemius, plantaris, and popliteus muscles; for, when flexed, their points of attachment are brought near to each other, and the parts left in repose.

Plate 18.

Fig. 1.



Fig. 3.



Fig. 2.

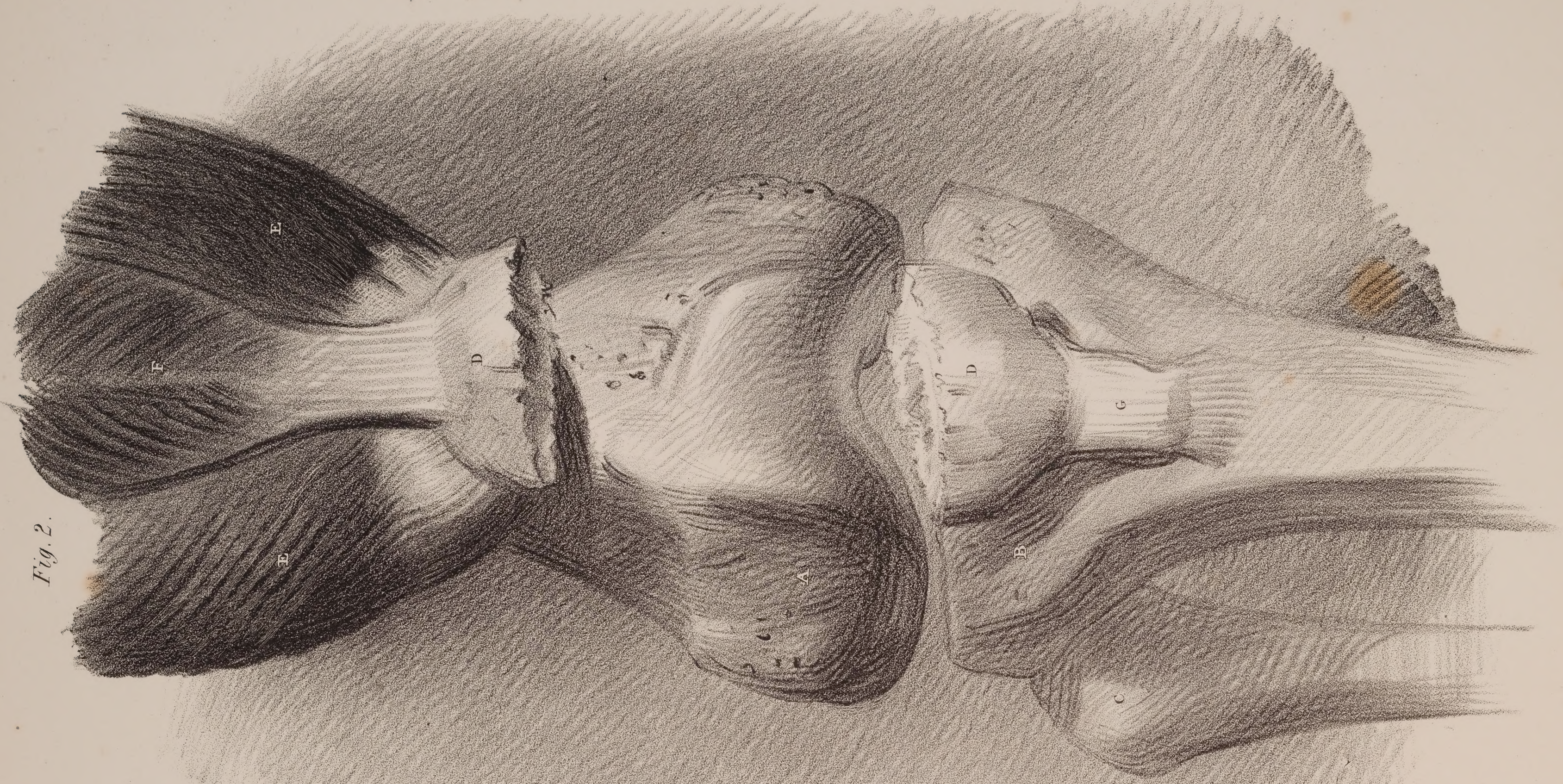


PLATE XVIII.

FRACTURE OF THE PATELLA.

FIG. I. — LATERAL VIEW.

- | | |
|-----------------------------------|-----------------------------|
| A. A. Broken Patella. | E. Vastus externus. |
| B. External condyle of the Femur. | F. Rectus femoris. |
| C. Tibia. | G. Ligament of the Patella. |
| D. Fibula. | |

FIG. II. — FRONT VIEW.

- | | |
|--|-----------------------------|
| A. Femur. | E. E. Vasti muscles. |
| B. Tibia. | F. Rectus femoris. |
| C. Fibula. | G. Ligament of the Patella. |
| D. D. The two portions of the Patella. | |

FIG. III.

The Patella fractured by violence directly applied.

CAUSES OF FRACTURE.

This bone may be broken either by the inordinate action of the muscles attached to it, or from violence directly applied to the part.

The former of these cases generally takes place during a fall, when the body inclining backwards, and the knee being at the same time in the bent position, the muscles attached around the upper margin of the bone contracting violently during the time that the fibres are partly upon the stretch (which they would be in this position,) the bone is broken through about its centre. In one of the many happy illustrations of Sir Charles Bell, he shows that when the knee is in this position, the whole of the articulating surface of the patella is not in actual contact with that of the femur, but that its centre only rests upon it, so that the bone is not broken by the force of these muscles acting on a line perpendicular to the upper surface of the bone, but obliquely from behind and above it; the bone being fixed at its lower edge by the ligament of the patella; so that the fracture takes place at the point which rests on the femur, which is the fulcrum, and while the muscles above are drawing backwards the upper edge of the bone, which now becomes the lever, the force being applied by the strong action of the extensor muscles.

When a blow is received upon this bone, as when a coachman falls from his box, &c. &c. the character of the accident becomes altogether changed: much more injury is done, not only to the bone itself, which will be shattered and stellated, as seen in fig. iii, but the surrounding parts suffer contusion, and the joint is severely injured.

APPEARANCES AND CAUSES OF DISPLACEMENT.

When transverse fracture of the patella has taken place, which is consequent upon the inordinate action of the muscles, the appearance of the knee at once attracts attention from its peculiar flatness, the prominence of the patella being no longer observable; and when the hand is applied to the part, the fingers sink into a hollow bounded by the two portions of the patella above and below, and on either side by the projections of the condyles of the femur: the upper portion of the patella will occasionally be drawn up into the thigh, even to the extent of four or five inches; but the limit of this displacement depends upon the extent of laceration of the fibres of the tendon of the quadriceps extensor or cruris: the lower portion retains nearly its natural situation, being supported by the surrounding fibrous tissue. The patient loses the control over the leg; it is useless, and has only the power of flexion; when he attempts to walk, it bends under him, having by the separation of the patella lost the power of the extensor muscles. The displaced portion may be felt above the knee, and, by extending the leg, may now be brought down with the assistance of the hand to its original situation; and when lateral motion is produced, the crepitus is at once evident.

The displacing muscles in this fracture are the rectus femoris, vastus externus and internus, with the cruræus, all of which are inserted around the upper edge of the patella; these raise the upper portion by their combined actions. The ligament of the patella holds the lower portion in its natural situation.

Should the fracture take place in a perpendicular direction, (which is comparatively a very rare occurrence,) little displacement occurs; for the two lateral portions, during the actions of the muscles, are by means of the articulating surfaces of the femur, which incline backwards meeting in the centre, forced against each other, and held in apposition.

TREATMENT.

The plan of treatment, upon the subsidence of inflammation, should be in the first place to flex the thigh upon the body, and to extend the leg fully, at the same time that the foot is raised above the level of the patient: the object will be at once evident upon considering the attachments of the displacing muscles. The muscles displacing the upper portion, which have been already enumerated, are the rectus femoris, vastus externus, vastus internus, and cruræus. The attachments of the rectus femoris above to the ilium, and at its inferior part to the patella, would necessarily be relaxed by raising the knee towards the pelvis, but not yet to the full extent: the patient should now be placed in a sitting posture, by which the attachments of the muscle are still more approximated and fully relaxed. In extending the leg, the lower portion of the patella is brought up towards that which is displaced; for should the limb be allowed to hang, the adaptation of the two surfaces would never be accomplished. Having secured the patient in this position, the upper portion of the bone should now be gradually brought down, until the broken surfaces are in immediate contact: a strong cotton roller is now to be passed several times round the thigh, above the upper portion of the patella, and secured; and another portion similarly applied below the lower portion of the bone: this being done, the two bandages should be made to approach by other pieces of roller passed below the two circular bandages, one on each side; and by tying the ends together, the bones are held in complete apposition: a soft pad of lint may now be placed upon the patella, and there held by means of a bandage lightly applied: other means are also recommended, such as the figure of ∞ bandage, and the leather straps of Sir A. Cooper, all of which answer the purpose equally well.

The union of this fracture is rarely accomplished by bone: where perhaps a small portion only is detached, union by bone occasionally takes place, but the more common union is by ligament.

Fig. 7.



PLATE XIX.

FRACTURES OF THE TIBIA AND FIBULA.

FIG. I.

- | | | | |
|-------|---|-------|--------------------------|
| A. A. | Broken surfaces of the Tibia. | F. | Gastrocnemius muscle. |
| B. | Fibula fractured. | G. | Popliteus muscle. |
| C. | Internal condyle of the Femur. | H. H. | Fibres of the Soleus. |
| D. | Patella. | I. | Tendon of the Plantaris. |
| E. | Tendon of the Quadriceps extensor cruris. | | |

FIG. II.

Transverse fracture of the Tibia only.

FIG. III.

Oblique fracture of Tibia and Fibula.

CAUSES OF FRACTURE.

Fracture of both bones of the leg may take place from the weight of the body falling with great force perpendicularly to the line of the tibia and to the axis of the foot ; in which case, the tibia instantly gives way, and the weight is then transferred to the fibula, which also gives way, and that, most usually, a short distance above the malleolus externus ; for this will be found the weakest point of the bone.

Both bones are likewise occasionally fractured at one and the same moment, and on the same line in both ; as when a weight passes transversely across the leg. The fibula may be separately broken (the tibia remaining entire) by the application of force immediately to the part ; as from a smart blow or kick : even the tibia may occasionally give way alone, leaving the fibula entire ; this accident is not, however, of so frequent occurrence, and is the consequence of a fall, the foot touching the ground while turned inwards ; by which means the fibula is prevented meeting the resistance of the os calcis below, and the person falls to the ground in the opposite direction, by which means the smaller bone is preserved.

APPEARANCES AND CAUSES OF DISPLACEMENT.

When both bones are broken, the appearance of the limb depends upon the nature of the fracture ; for when it takes place in a simply transverse direction, little displacement occurs beyond a depression of the lower portions, which not only fall by the weight of the foot, but are assisted to that position by the mass of muscle on the posterior part of the leg : the surfaces do not remain wholly in contact, but rest against each other at their posterior edges, so that the broken surfaces project forward, and are evident below the integuments. But should the fracture have taken place obliquely, the displacement, and consequent injury, would be greater, and the case rendered naturally more complex.

The fracture (as seen in fig. i.) is of this kind, and has taken a direction obliquely from before ; downwards and backwards the obliquity is considerable, and by the power of the whole of the muscles the two surfaces slide easily the one over the other ; but in consequence of the muscles on the posterior part being stronger and more numerous, the heel is drawn backwards, independently of the shortening, so that the displacing causes in this case are precisely the same as in transverse fracture, but producing a greater displacement, altogether dependent upon the circumstances of the fracture.

Where the fracture is the inverse of that shown in the plate, the upper portion would project, and the lower would be drawn backwards and upwards.

In either of these cases, the diagnosis is at once formed ; for, by tracing with the finger along the anterior spine of the tibia, the irregular edges of the broken surfaces are felt prominent under the skin, or seen even projecting through it, thus rendering it compound. When the obliquity of the fracture is in a lateral direction, (as in fig. iii.) the displacement would differ from either of those already described : the lower portions of the tibia and fibula in that case would be drawn backwards and upwards, from the causes already described as acting upon those fractures before enumerated, and inclining outwards, not altogether from the obliquity of the surfaces, but likewise from the action of the muscles giving them that direction.

Compound fracture of the tibia is of frequent occurrence, in consequence of this bone being situated so immediately below the integument, and covered solely by it : the lower extremity being drawn backwards, the end of the bone is protruded through the integument, the weight still continuing to act ; the lower portion is thus driven over the superior, and there held firmly by the whole of the muscles of the leg, acting simultaneously ; but in consequence of those on the posterior part being more numerous, and possessing superior power, even to the raising the whole weight of the body, the heel is drawn by them backwards and slightly upwards.

When the tibia is fractured, and the fibula remains uninjured, (as in fig. ii.) the accident is not so easily detected, for then the fibula is the means of preventing the displacement of the fractured surfaces : however, by passing the finger along the anterior spine, the irregularity can be at once felt ; and by rotating the foot, the knee being at the same time fixed, the crepitus is distinguished.

Should the fibula alone suffer fracture, some difficulty may also be experienced in detecting it ; but by pressing the thumb firmly against the bone at any situation in the direction towards the tibia, the crepitus can generally be felt. Much tumefaction accompanies this fracture, as it usually follows immediate injury of the part, and from the circumstance of the patient not unfrequently walking after the accident.

TREATMENT.

The adaptation of the broken surfaces offers very little difficulty, unless the tibia projects through the integument ; in which case, should the bone project to any extent, the reduction is difficult, and cannot be effected unless the leg be flexed, and the lower portions of the bones directed backwards ; and this attempt proving unsuccessful, it may be necessary to remove a portion of the projecting bone with the saw.

The difficulty which exists in this case, (see fig. i.) depends not only on the strong muscles already described as drawing the lower portions of the tibia and fibula upwards, and directing the heel backwards, but also upon the muscles situated between these bones on the anterior part of the leg (which are, the tibialis anticus, extensor digitorum communis, and extensor longus pollicis) : these, in consequence of the thrusting forwards of the lower portion, are put upon the stretch, and are the means of holding the two portions more closely and firmly together ; those fibres also of the soleus muscle which are situated below the point of fracture, have likewise the effect of holding the lower portion of the tibia in firm relation with the upper portion.

The principle upon which fracture of both bones of the leg should be treated, is to place the limb in that position in which the whole of the muscles would become at once relaxed ; for this purpose the double inclined plane is occasionally adopted, particularly in cases of compound fracture, for by its use the parts are more readily examined and redressed, without the necessity of disturbing the limb.

But where the fracture has not become compound, the usual method is to place the leg upon the short splint, (Sharp's splint,) so padded with tow or cotton as to be well adapted to the inequalities of the limb : in this position, as when placed upon the inclined plane, the leg is bent upon the thigh, by which means the gastrocnemius, soleus, plantaris, and popliteus are relaxed, as well as the semimembranosus, semitendinosus, and biceps. The knee should also, at the same time, be brought towards the pelvis, in which position the rectus, &c. are likewise relaxed. In this manner the bones will remain in the situation in which they have been placed, unacted upon by the muscles. In the simple fracture of both bones, as in the subsequent treatment of compound fracture, as far as the immediate mechanical assistance of splints and bandages are concerned, upon the subsidence of the inflammation and tumefaction, it may be

conducted thus:—A long soft pad should be adjusted both to the outer and inner surfaces of the leg, extending in its whole length; over these a long firm splint may be placed on either side, and secured moderately tight by means of a soft cotton roller extending from the foot to the knee: these splints should project beyond the sole of the foot, and are the means of preventing the twisting of the foot laterally. Over this roller may now be applied on the anterior part of the leg along the line of the tibia, a third splint, surrounded with tow, and secured in like manner: in this way any displacement that might otherwise take place is prevented: the limb being now placed either upon its side or on the inclined plane, as described above, the parts are retained in apposition.

The treatment of fracture of the tibia only, may also be conducted as the foregoing.

In fracture of the fibula, the splint which is applied to the outer part should project beyond the foot, in order to prevent the turning outwards of the foot.

PLATE XX.

FIG. I.

POTTS' FRACTURE.

Fracture of the Fibula, with partial dislocation of the Tibia from the Astragalus.

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|-------|--------------------------------|-------|--|
| A. | Lower end of the Tibia. | G. G. | Ruptured Deltoid ligament. |
| B. B. | Broken surfaces of the Fibula. | H. | Part of the Peroneus longus muscle. |
| C. | Malleolus externus. | I. | Part of the Soleus muscle. |
| D. | Astragalus. | J. | Tendon of the Tibialis posticus. |
| E. | Os calcis. | K. | Tendon of the Flexor longus digitorum. |
| F. | Interosseous ligament. | L. | Tendon of the Flexor longus pollicis. |

CAUSES OF FRACTURE.

This accident takes place when a person is in the act of jumping, and when the foot alights upon an uneven part of the ground, so as to be twisted outwardly; or it takes place when a heavy man stepping from the carriage-way to the foot-path, places the outside of the foot only on the curb-stone, and it slips into the gutter everted. In either of these cases, the tibia does not rest perpendicularly upon the astragalus; for in consequence of the turning outwards of the foot, the weight of the body forces the tibia from off the astragalus, separating its attachments to this bone, and also the ligamentous connexions with the fibula, so that it glides easily over the inclined surface of the astragalus; the malleolus internus protrudes inwards, and, in consequence of the eversion of the foot, the attachments of the triangular or deltoid ligament are drawn apart, and rupture of the ligament necessarily follows. The weight of the body is no longer supported by the tibia, for it is already partly dislocated from off the astragalus, so that the weight is now transferred to the fibula, and, by means of the eversion of the foot, the lower end of the fibula rests upon the os calcis; but being unable to sustain the weight, it gives way about a hand's breadth above the malleolus externus, (the two broken surfaces resting against the tibia,) which will be found the weakest point in the bone, for here the spines which strengthen its whole extent become nearly deficient, and the bone is consequently thin and weak. It sometimes occurs that the tibia is completely driven from off the astragalus; in which case the integument would suffer laceration, and the accident become compound.

APPEARANCES.

When this fracture has taken place, the foot will be found twisted outwards, the inner edge directed downwards, while the outer side will be turned upwards; so that, instead of the sole of the foot resting on the ground, the inner part of the ball of the great toe and heel will occupy its situation: the motions of the foot will be altogether lost, and an attempt to bear upon or move it produces excruciating pain: a prominence will be seen at the inner side of the ankle, from the projecting end of the tibia; while on the outer side, just above the external malleolus, a depression exists, in consequence of the lower portion of the fibula being driven and held against the tibia, and the integument necessarily following it. The toes will be directed downwards (pointing), and the heel at the same time elevated.

CAUSES OF DISPLACEMENT.

The force having been applied, and the fracture produced, as already explained, the whole of the muscles on the posterior part of the leg are at once brought into action, and are, in consequence of their displacement, altered in the direction of their natural action; so that, instead of controlling the motions of the foot and direction of the toes, they now, from their combined effort and altered situation, hold the

foot in the position shown in the last paragraph, viz. turned outwards. The muscles producing this deformity on the outside, are the peroneus longus and brevis ; while those passing behind the malleolus internus are, the tibialis posticus, flexor digitorum communis, and flexor longus pollicis. The heel is drawn up, and the toe pointed, by the action of the gastrocnemius, soleus, and plantaris muscles.

TREATMENT.

The nature of the fracture will be at once evident upon examination ; the end of the tibia will be readily felt, over which the integument is stretched ; the accident is accompanied by considerable tumefaction and ecchymosis ; and upon moving the lower end of the fibula with the fingers, the crepitus is generally distinguished. In order to reduce the parts to their natural situation, it will be necessary, in the first place, to relax those muscles retaining the bones in their displaced positions ; for, should the attempt be made without attention to this circumstance, much pain will be the consequence, and in all probability the attempt will prove unsuccessful. For this purpose the leg should be flexed upon the thigh, by which means the muscles situated on the posterior part (which have already been enumerated) would be relaxed and the parts set at liberty : by now producing extension, at the same time giving the foot the natural direction, the parts are reduced and the deformity disappears.

The limb should, upon the subsidence of the inflammation, be laid upon the outside on the short splint, and flexed in the same manner as in fracture of the tibia, and secured to it by soft pads placed under the tapes which fix it to the splint ; and as the parts are gradually restored to their proper state, another splint may be applied upon the inner side of the ankle, well padded and secured by a firm cotton roller : proceeding in this manner, after allowing a sufficient degree of rest, the common lath splints may be substituted, and passive motion of the joint occasionally permitted.

FIG. II.

FRACTURE OF THE MALLEOLUS INTERNUS.

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|------------------------|--|
| A. Tibia. | D. Malleolus internus separated from the shaft |
| B. Fibula. | of the bone. |
| C. Malleolus externus. | E. Astragalus. |

This accident is produced by the same means as the last, fig. i, only that the foot when meeting the ground is inverted, by which the whole weight of the body is sustained by the malleolus internus, and it gives way at the moment the shock is received : the tibia and fibula are then driven forcibly from off the astragalus, passing outwards. The deformity in this case is precisely the reverse of that which takes place as described in the last accident, and consequent upon the same causes : the treatment may therefore be conducted in the same manner, by laying the limb on a splint extending from the knee and adapted to the form of the leg and foot ; or, in this accident, the limb may be placed on the double inclined plane, with splints applied on either side, extending beyond the foot, and well padded with tow or cotton.

THE END.

